Intellectual property rights and their influence on ICT innovations in Kenya

Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor of Business Administration (DBA) by

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Abstract

This research looks at ICT innovations and their potential to change and elevate a country's growth and enhance global competitiveness. The objectives in this research are determining the innovators understanding of IP, IPRs, exploring the role and support of international ICT companies in Kenyans ICT innovations with focus on IPs and exploring government's role in promoting ICT innovations and protecting the innovators through enforcement of IP laws.

I have looked at ICT innovators and the challenges they are facing through fact finding by use of research questionnaires both quantitative for innovators and qualitative for government officials, IP lawyers and ICT industry experts.

The key findings suggest the Kenyan ICT innovators need to read and understand IP and the laws available to protect their innovators. International companies have a key role of developing and transferring knowledge to local innovators and investing in local innovations. The government needs to play its role to ensure responsive and practical IP laws and IP policy. The involvement by government of academia and business will provide a platform to lobby government on appropriate IP policies.

The causal conditions that affect the innovators, from little knowledge of patents to weak enforcement of IP laws and the potential and real loss of IPs and subsequent loss of government revenues and means of livelihood have led me to conclude that this research is significant both for academic purposes and for providing potential solutions to these challenges. Such solutions would have a direct impact on the Kenyan economy given the significance of ICTs in Kenya's GDP growth.

The capability to innovate and to bring such innovations successfully to market continues to be increasingly a crucial determinant of global competitiveness of nations over the coming decades. There is growing awareness among policymakers in governments that innovative activity is and will become the main driver of economic progress and well being as well as a potential factor in meeting global challenges in many domains such as health, education, agriculture, water and sanitation among other domains. Innovation has not only moved to the center-stage in economic policy making, but there is a critical realization that a coordinated, coherent, whole-of-government approach is necessary and will be required to ensure nations succeed in tapping their innovation potential for national growth and global competitiveness.

I adopted purposive sampling since the target population has certain characteristics and knowledge of and align with the research objectives. Purposive sampling is a non-probability sampling method and the

sample is elected based on the researcher's judgment, which saves time and money. A sample of 37 innovators responded to the quantitative questionnaire and for the qualitative research 3 IP lawyers, the CEO of a copyright protection agency, the Permanent Secretary of Ministry of ICT and 3 executives of the ICT industry responded to the questionnaire.

A pilot test was carried out on volunteers to test the veracity and in-depth coverage of the questionnaires, which led to further improvements. The design of the questionnaires was focused on getting responses on how well if at all the research participants understand IP laws that currently exist how lack of knowledge of such laws has impacted them. During data collection, I was keen to know about the innovators' interaction with international ICT companies and whether they have assisted them to understand IPs and how to apply them. Government is critical in formulation, enactment and enforcement of IP laws. The research questions have focused on government's role in the promotion and protection of innovations.

There were delays in obtaining information from several government agencies, which eventually became available, but after significant loss of time. The subsequent generation of a lot of data, presented limitations of trying to achieve a balance between data analysis paralysis and data analysis that is succinct.

This research has highlighted the potential areas for government to provide financial support, preferential procurement opportunities and tax incentives to innovators. The government comprehensive intellectual property Policy and strategy would address IP policy coherence and assist in the integration of IP in the national development strategies and plans such as the Vision 2030. This will also ensure IP cuts across government ministries, departments and agencies because of its cross-sectoral nature.

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I Ethical considerations

There are several ethical considerations that relate to this research. These include general ethical considerations and review of the ethics framework, which has been designed to provide and ensure maximum protection to the research participants.

General research ethics issues

Ticehurst and Veal (2000) have highlighted a number of considerations for the researcher.

- Competence. As a researcher I should not start or commence the research without the requisite skills, competence and training.
- Literature review. Literature review must precede any research so as to ensure that as much as possible, the proposed research addresses specific problems or challenges with the intent of finding solutions and suitable and practical recommendations.
- Plagiarism. The use of data or ideas from other researchers without duly acknowledging and seeking written permission, where appropriate, is considered unethical.
- Falsification of results. The presentation of research results that are false or have been falsified is unethical.

In the context of the researcher and the research participant relationship, Ticehurst and Veal (2000) contend that the two main principles are that the research participants take part freely, based on informed consent and no harm should befall the research participants.

Ethics framework

Patton (2002) has explained further and reinforced the need for an interviewer to have an ethical framework, within which to carry out data collection. The table below provides an outline.

Table 1 - Ethics framework

Issue	Mitigating action	Reference
Legitimacy of the research activity	Contact details of University of Liverpool, research supervisor, and Ethics Committee representative provided to research participant	Consent form
Research participants	Research participants were provided with the	Participant information

fully informed	participant information sheet, which detailed: -background to the research -envisaged research procedures -possible discomforts and risks -researcher responsibilities -research participant responsibilities -freedom of consent -UoL contact details	sheet
Informed consent	-Interview subjects were informed they were under no compulsion to participate initially or to remain in the research activity if they chose to withdraw. -Subjects were provided with a copy of the informed consent to participate in advance of the interview date.	Consent form Participant information sheet
Anonymity of subject and confidentiality of information	All data 'de-identified' in the thesis report, and all source documents kept in secure location.	Consent form Participant information sheet
Comfort of research participants	Research participants offered the choice of choosing the interview location and costs of travel and refreshments catered for by the researcher.	Participant information sheet
Research to be conducted within accepted academic research protocols	Ethical approval granted by University of Liverpool research ethics committee	Research ethics committee approval received before start of research

Developed for this research, Ticehurst and Veal (2000, pp.51)

Ethics committee approval

This thesis research and its data collection process and approach has been approved, subject to the standard conditions of approval, by the University of Liverpool ethics committee.

All reasonable steps have been considered and taken to ensure that research participants were and have been fully informed about the data collection process and the thinking and rationale behind the research. The research participants have not been engaged in the data collection process and activity against their will, and the interviews were conducted in an environment of the research participant's choice, to ensure their comfort. The data collection process was conducted within accepted academic research protocols and with the approval of the University of Liverpool research ethics committee.

II Declaration

I hereby declare that this Doctoral thesis which is entitled '***Intellectual property rights and their influence on ICT innovations in Kenya***' submitted in fulfillment of the requirements for the award of the degree of Doctorate of Business Administration of the University of Liverpool, is my original work and to the best of my knowledge, ability and belief, does not contains material previously published except where in the case and where such acknowledgement is duly made in the thesis.

It is my certification that the substance of this thesis has neither in part nor in whole been or is not currently being submitted for any other degree at this or any other university.

It is also my certification that all help received during the preparation of this thesis and all its sources and resources have been duly acknowledged.

Joseph Waruingi

III Abbreviations

AR – Action Research

ARIPO - African Regional Intellectual Property Organization

BPO – Business Process Outsourcing

CA – Competition Authority of Kenya

CBK – Central Bank of Kenya

CEO – Chief Executive Officer

CoI - Community of Innovators

DBA – Doctorate of Business Administration

DOT – Digital Opportunity Trust

DVs – Digital Villages

FDIs – Foreign Direct Investments

IC – Intellectual Capital

ICT – Information and Communications Technology

ICT4D - Information and Communications Technology for Development

IP – Intellectual Property

IPRs – Intellectual Property Rights

IT – Information Technology

ITES – Information Technology Enabled Services

KICTB – Kenya Information and Communications Technology Board

KICTANet – Kenya Information and Communications Technology Action Network

KIPI – Kenya Industrial Property Institute

KITOS – Kenya Information Technology and Outsourcing Services

KM – Knowledge Management

MoIC – Ministry of Information and Communications

PLC – Product Life Cycle

RBT – Resource Based Theory

RBV – Resource Based View

R&D – Research and Development

RoI – Return on Investment

SMEs - small and medium-sized enterprises

SSA – Sub Saharan Africa

SSC – Shared Service Centre

STI – Science Technology and Innovation

TTO – Technology Transfer Office

USAID – United States Agency for International Development

VCs – Venture Capitalists

VKB – Virtual Knowledge Brokers

WTO – World Trade Organization

WIPO – World Intellectual Property Organization

IV Acknowledgement

This research could not have been completed without the support and expertise of many people since a DBA undertaking is a career and life-long changing experience and I would like to thank and acknowledge a number of people.

First and foremost and on an individual basis, I owe an enormous debt of gratitude and express my sincere appreciation to my supervisor, Dr Nii Amoo. During the conduct of this research, Nii guided me along a most treacherous and difficult research path and his powerful intellect always cut straight to the issues and cleared the way ahead. Nii's support and persistence made the doctoral thesis journey fun, truly rewarding and unforgettable.

Nii encouraged me at all stages especially when I was facing huge challenges with data collection, and provided me key and useful insights in the conduct of this research. He provided me with valuable comments and thoughts and each encounter with him largely on telephone and Skype was unique and invaluable. Nii took a genuine and personal interest in my thesis work.

I also express my sincere gratitude to the faculty of DBA and school of management, all my coursework facilitators throughout my Doctoral journey from September 2010. I cannot name all of them in the space I have, but they were instrumental in my learning experience throughout my often, challenging DBA journey.

The nature of this research prevents me from individually acknowledging the research participants whose insights formed the basis of the research findings. The participants gave generously to me, and this research their expertise, knowledge and above all their time through participation in the research interviews. I thank them most sincerely for their valuable contributions.

The DBA experience would not have been complete without the knowledge, information sharing and exchange with my cohort colleagues. The time we spent together interacting in the Blackboard and the DDP residencies in Liverpool make me nostalgic and I remain hopeful that we can continue to stay in touch.

The pursuit of a DBA is a large and onerous task. However, when pursuing it with the support of family, friends, colleagues and supervisors it is also an enjoyable and highly rewarding undertaking. I have been fortunate to have such support, and I am deeply thankful for that.

Finally, I would like to thank my family – my wife Elizabeth, our two sons Ian and Christopher for their extraordinary support. Their words of encouragement meant so much to me. They believed in me, and my abilities to pursue the DBA and sacrificed family time to allow me concentrate on my DBA studies. Indeed without their help and understanding, I would not have been able to meet the demands of doctoral studies in parallel to my full-time professional activities and my role as a husband, father, son and community leader. My family has been patiently waiting for the graduation ceremony so that they can enjoy the moment.

1 Introduction and background

1.1 Research aim and objectives

The focus of the research is intellectual property rights (IPRs) and their influence on ICT innovations in Kenya and to collect relevant data, I have formulated three research objectives, which are to:

a) determine the innovators understanding and challenges of IP, IPRs and IC
b) explore the role and support of international ICT companies in Kenya's ICT innovations with focus on IPs
c) explore government's role in promoting ICT innovations and protecting the innovators through enforcement of IP laws

The innovators knowledge of IP laws is important in assisting them to protect their innovations. Kenya being a regional hub in Eastern Africa attracts global ICT firms some who have their regional headquarters in Nairobi and others who have not yet established a physical presence in Nairobi. These companies are part of Kenya's ICT innovations ecosystem and have an impact, which this research has attempted to establish.

The government's role in the support and protection of innovations of its citizens cannot be over emphasized (Hall, 2005). It is government that formulates and enforces laws. The three arms of government – executive, legislature and judiciary, each have a role to play in developing and enactment of relevant laws to protect IP. Innovators rely entirely on government to assist them protect innovation and to get restitution in the event of loss or theft of their innovations (Maskus, 2000).

The government policy of Science, Technology and Innovation (STI) promotes sustainable development through social integration of communities. STI also promote the sharing of knowledge, preservation and enhancement of indigenous culture and knowledge. The government of Kenya in its Vision 2030 vision and blueprint proposes to transform Kenya into a middle-income country, to intensify the application and adoption of STI for purposes of raising efficiency and productivity. The STI policy is supportive of Vision 2030 with more resources targeted at scientific research, development and training of requisite workforce technical capabilities and revision of curricula in schools, tertiary colleges and universities to ensure a curriculum that is relevant to the industry human resource skills' needs.

The Kenyan parliament in 2013 enacted the STI law to provide the right environment and appropriate institutional support to enable achievement of the ICT sector objectives. This include increase in university enrollment, encouraging the girl-child to choose and study science and technical subjects, upgrade of technical institutes to national tertiary colleges and allocation of more funds to the National Research Fund with the annual ceiling set at USD 4 million with regular annual increments.

In August 2010, Kenya promulgated a new constitution and one of the key components of the constitution is devolution of resources to forty-seven counties. The STI act therefore envisaged the setting up of county STI centers of excellence, establishment of an open university and an inter county knowledge transfer programme which would strengthen the linkages between the knowledge users and generators of such knowledge. The setting up of a National Innovation System, a science and technology park and technology incubation facilities were all envisaged in the STI act.

1.2 Research rationale and significance

Within the Kenyan context, Intellectual property rights (IPRs) especially in the knowledge and information economy have hitherto not been well development but from 2000 they are increasingly being used for intellectual capital (IC) leverage. 2010 is the year that mobile phones were introduced to Kenya. The granting of IPRs is the responsibility of the Kenya Industrial Property (KIPI) under the Industrial Property Act (2001). Innovators can also obtain patents through the African Regional Intellectual Property Organization (ARIPO), which is mandated by the member countries, Kenya being one of them to grant patents in consultations with KIPI.

In addition to the rapid and great progress in scientific discovery and in general-purpose technologies such as ICTs and biotechnology, the increasing pace of innovation is being driven by more by globalization. Government policies can and need to support innovation by reforming the regulatory and institutional frameworks within which innovations activity take place. The public policy and regulatory framework need to be more conducive to innovation in a range of policy areas from the general business environment.

Governments have a very important role of fostering innovation (Arundel and Kabla, 1998). Public investments in science, research and technology can play a vital role in developing ICTs and hence, in enable further innovation. This highlights the importance of reforming the management and funding of public investment in technology and science to innovative activity in the private sector. The latter calls for an appropriate mix of direct and indirect instruments such as tax credits, direct support and well-designed public- private partnerships, support for innovative clusters and rigorous evaluation of such public

support.

The current system of IP laws, practices and rules in Kenya appear not to have done enough to stimulate high-level innovation while allowing access to knowledge according to the study participants. Strong patenting systems and enforcements of relevant laws in the event of breaches are necessary to combat piracy, counterfeiting or outright theft, which are serious and growing problems (Chabchoub and Niosi, 2005).

Today, innovative performance is a crucial factor in determining competitiveness and national progress. Innovation is important to help address global challenges, such as climate change and sustainable development. But it is the application of advances in technology, in conjunction with entrepreneurship and innovative approaches to the creation and delivery of goods and services, which translates technological and scientific advances into more productive economic activity. This results in economic growth if market structures and the regulatory environment enable the more productive activities to expand. This said, the innovative effort itself, including formal research and development, remains the *sine qua non* of growth (Brouwer and Kleinknecht, 1999).

Evidence by the OECD in its 2007 report on innovation and growth, suggests that innovative effort is on the rise as a share of economic activity. Investment in knowledge has grown more rapidly than investment in machinery and equipment since the mid-1990s. Intellectual assets taken as a whole in terms of aggregate measures of human capital, research and development and capacity to conduct it, patent valuations as well as intangible assets such as brand value or firm-specific knowledge — are rapidly becoming the key to value creation through a number of channels.

The importance of innovation has been spurred and reinforced both by globalization and by rapid advances in new technologies, notably ICTs, which have enabled new forms of competition and opened new markets for the creation and delivery of innovative products and services. Globalization has also increased the pressure on countries to move up the value chain and engage in a continuous process of adjustment and innovation. As a result, major emerging market economies are no longer simply low value- added producers but are adding their weight to the creation and commercialization of innovative products, processes and services (Granstrand, 2003).

As Kenya works towards repositioning the economy to be driven by innovation and exponential growth of the service sector through Vision 2030, there are some issues that require a critical analysis as argued out by Goh (2005). How to frame investment opportunities such an innovation-driven economy and

determination and documentation of the emerging opportunities. The new investment models necessary as well as acceptable and viable commercial strategies to underpin the innovation investments and identification of the resources and structures within government to drive this national agenda. The operational, tactical and strategic needs that emerging an growing economies require as nuanced intellectual capital investments and the nature of the **RoI2** (returns on innovation investment) and **RoRi** (returns on research investment) and the politically acceptable returns in a growing economy (Lai, 1998).

The public sector institutions in Kenya that are tasked with the protection and promotion of innovations as well as fighting against counterfeits tend to work at cross-purposes and turf wars among them are not uncommon. They appear to lack the drive that is crucial for entrepreneurship protection as well as appropriate flexibility to operate in commercial environments where value is gained or lost based on time taken to execute and implement decisions. In this environment, innovation systems are kept in a 'low equilibrium trap' with low levels of R&D and mis-allocation of R&D resources. Instances of vested interests sometimes in government and the need to maintain the status quo hinders innovations, as is the fear to get to uncharted waters for some government agencies whose mandate is to promote and protect innovations. As the policy, legal and economic environment are still evolving, the situation in the field of IP for ICT innovations is still evolving and strong IP laws and policy need to evolve in tandem.

Kenya is the largest economy in East Africa and the seventh largest in Africa with a GDP of USD 60 Billion (http://www.tradingeconomics.com/kenya/gdp). Kenya has also developed a 25-year development blueprint called 'Vision 2030' (http://www.vision2030.go.ke), in which the contribution to GDP by ICTs is given prominence. The government envisages that by 2030, ICTs will contribute 10-12% to GDP growth. It is therefore clear that the government sees ICT induced growth as key to the growth of the Kenyan economy.

With a population of 47 million as per 2016 Kenyan National Bureau of Statistics figures, Kenya has 70% of the population being youth, below the age of 30. The youth have the flair and attitude to understand and use the latest technologies and the government recognizes the power and resource of the youth as per its STI policy.

1.3 Research terms of reference

In this section I outline the approach used to achieve the research objective outlined above and the major steps followed in the quantitative and qualitative analysis.

For each of the three research objectives, a questionnaire using the Likert scale was developed. There was

initial consideration of the nature of the research problem and definition of the target population and approach to purposive sampling. Focus on selection of research variables to represent objective and to ensure objective was clearly defined. For the quantitative research, a questionnaire using the Likert scale was developed, with grouping based on the research objectives.

To ensure a foolproof questionnaire, a pilot test was carried out on volunteers to test the veracity and in-depth coverage of the questionnaire. The pilot led to further improvements before the questionnaire was administered on the sampled population.

For the qualitative questionnaire, I asked one of the respondents, the Permanent Secretary for ICT to respond to the questionnaire to determine, its utility. I made further improvements before I carried out formal interviews with other selected participants.

The design of the questionnaires was focused on getting responses on how well if at all the research participants understand IP laws that currently exist how lack of knowledge of such laws has impacted them. During data collection, I was keen to know about the innovators' interaction with international ICT companies and whether they have assisted them to understand IPs and how to apply them. Government is critical in formulation, enactment and enforcement of IP laws. The research questions have focused on government's role in the promotion and protection of innovations.

Other components of the research questionnaire are age, age of firms, size of firms, gender – to determine whether IP challenges are across gender, Kenyan citizenship, to see if there are non-Kenyans working on innovations locally to determine if the Kenyan innovation ecosystem is attracting non-Kenyans. I also asked them about their job title to determine if they are in senior position to handle strategic innovation issues. I was also keen to know how long they have been innovating to determine whether they have been in it long enough and navigated major business challenges.

The participants in this research have had knowledge and experience of the ICT innovations ecosystem in Kenya. This research is therefore grounded on data and information from the participants. Strauss & Corbin (1998) argue that as an inquirer, I need to look at ICT innovators and confirm the challenges they are facing through fact finding and then generate the reasons why the innovations protection environment has not been fully supportive to them.

To my knowledge and belief such research has hitherto not been a subject of previous research in Kenya. The research process has therefore been exploratory in nature – moving from the known to the unknown. An exploratory study is undertaken where the researcher has some basic knowledge of a subject and seeks to know much more about the situation that obtains in the field of research. (Sekaran,1992).

I consider that a critical step in undertaking research such as this is the selection of an appropriate paradigm within which to conduct the research. A paradigm, or 'a view of the world', is a conceptual framework comprising a basic set of beliefs or assumptions that act as a guide to the researcher (Creswell 1994; Healy & Perry 2000), providing a clear distillation of the researcher thinking regarding the world, but which thinking the researcher is not able to prove unless with the help of the research process to its conclusion (Lincoln and Guba, 1985).

1.4 Research limitations

A number of my potential respondents who are senior government officials did not respond to my questionnaire and requests for an interview. Constant reminders did not yield positive results. A number of corporate innovators declined to respond to the quantitative questionnaire citing confidentiality and desire to keep their innovations and plans secret and possibly for fear of losing their ideas. Other innovators declined citing agreements with their investors. About seven number of innovators said the questionnaire was long and did not complete it. Several appeals to them to complete the questionnaire were not successful.

The ICT Authority of Kenya has come under criticism from the ICT fraternity for lack of success stories of Kenyan ICT innovators who have scaled their innovation to commercial levels. Not surprisingly, I experienced difficulties and delays in obtaining information from the authority since the ICT community has put them under pressure for perceived non-delivery.

In many other instances, I held informal meetings where I obtained a lot of information but I had little time to take notes because the interviewees mostly government officials and IP lawyers declined to be recorded.

In terms of data analysis, I had immense challenges using SPSS software and I had to learn the skills, which took long before I started data analysis, In the process of data analysis, I had to constantly refer to manuals and do internet research on suitable analysis methods for the data I had collected. In determining data validity and reliability, I made many mistakes and it took long before I used the correct methods.

On report writing, based on the fact that I had a lot of data, I had immense challenges determining which data to use in the body of the report and which data to put in the appendices. This took me a long time and discussion with my supervisor, especially since I wanted to make sure that the data analysis section is clear and readable. The format of the table to ensure they are not too dense, also took time as was labeling the tables for ease of reference.

2 Literature review

This literature review starts with explaining a number of concepts, the conceptual framework and trends which include the emergence of a pro-IP era, in which the importance of IP has grown, and the increased focus on open innovation, setting new requirements on IP management.

2.1 Literature review framework

The framework for this research is based on IP systems - IP rights, IP laws, IP enforcement and protection, IP and innovation including types of IP and rationale of IP for innovation. IP management and completion consists on innovation appropriation, IP management trends and international trends where WIPO provide guidelines to member states on IP adoption, maintenance and renewal (Pim, 2010). The innovation ecosystem where government, academia and business, including innovations is key to success of innovators. IP governance, economic growth and job creation are important especially to governments, for economic growth, growth in tax revenues and quality employment to the youthful population. I have focused on IP and competition to the extent IP holders can stifle fair competition and IP alternatives to IP especially with continued growth of internet technologies. This being action research, I have focused on knowledge creation and sharing such knowledge with government agencies that may find it useful (Echambadi and Campbell, 2006).

The Figure on the next page provides the pictorial form of this framework.

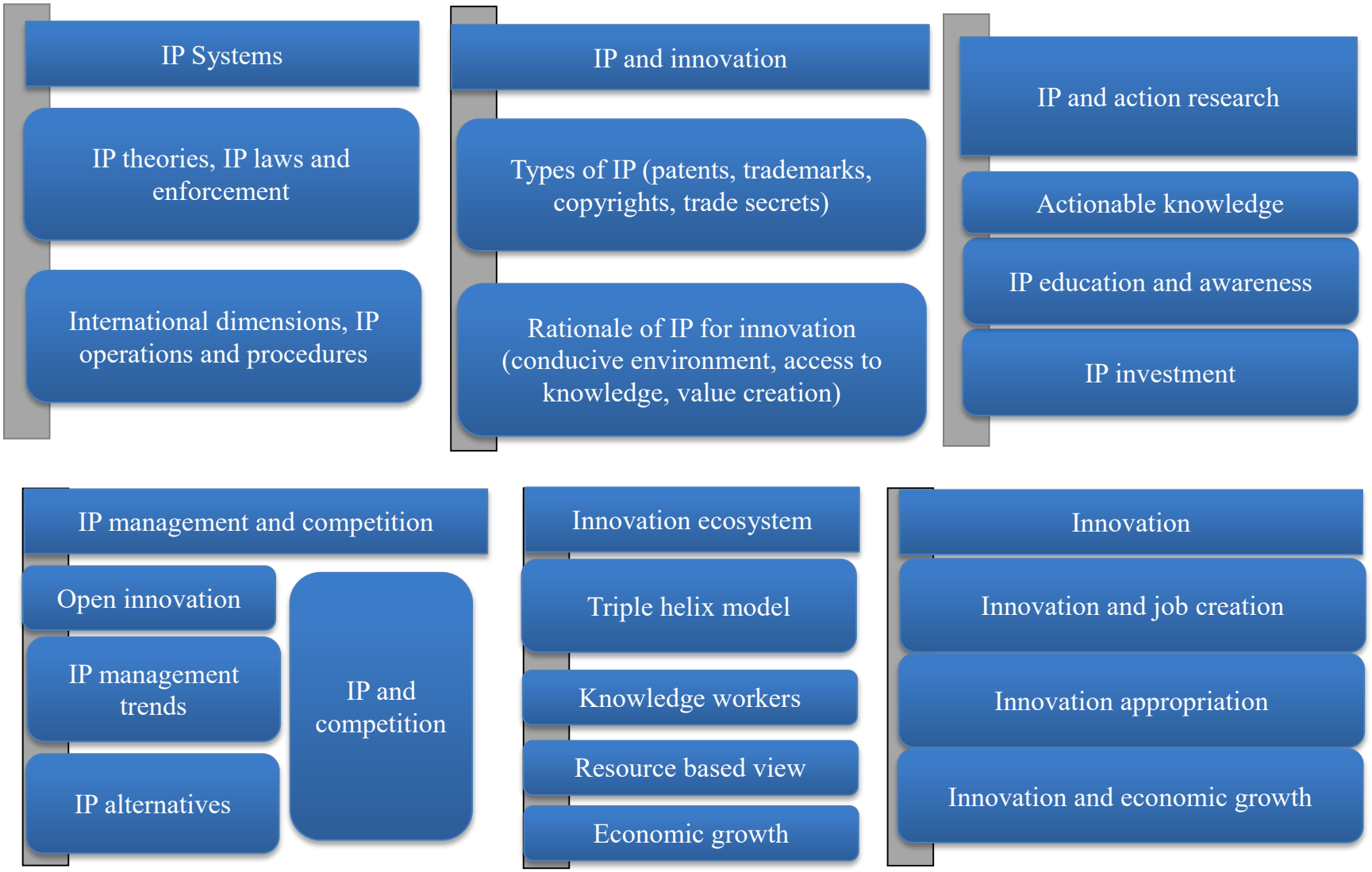

Figure 1 - Literature review framework

Pim (2010) in their article ‘Capabilities for managing innovation: towards a conceptual framework", argue that ICT innovation exists in an IP environment which is an interplay of several factors, whose aim is to provide protection to the innovators from the loss or theft of their innovations (Baumol, 2002). The environment consists of among other things, the mechanisms and regulations available to innovators to protect their innovations (Echambadi and Campbell, 2006) and the knowledge gained in the innovation process, ICT innovations also influence human action and interaction of organizational properties such as skills, talents, ease of doing business, reduction of time-to-go-to market and injection of efficiencies to business processes. Organizational rules, processes and procedures affect the way ICT innovations are adopted in an organization, the process of ICT innovators (Baumol, 2002) in marketing and selling their innovations to businesses and the extent to which such innovations are protected mainstreamed and institutionalized. This determines the value organizations attach to the innovations that they buy and could lead to new business for the innovators (Etzkowitz, 1993).

According to Serrat (2011), innovations have continued to play pivotal roles in economic development around the world. The build-up of innovation capacities has been central to successful growth and IP rights are important for building these innovation capacities. IP rights provide incentives to innovate in various fields. IP serves innovation by providing incentives for inventions and it facilitates access to knowledge thereby stimulating innovations by addressing information asymmetry, enhancing global competitiveness and creating job opportunities (Walsham, 2003).

Innovation performance at a country level depends on several factors including innovation policy. A country’s national IP system is a policy aspect of significant impact on innovation (Suciu and Ghitiu-Bratescu, 2009). The IP system allows a market-based economy to produce innovation while providing foundation for other government interventions to be more effective (Eaton, Kortum and Lerner, 2003).

The relevance of ICT innovations, their value to individuals and industries is a topical research worthy of pursuit. Innovations and their value to the innovators lead to several emerging directions of research such as protection of such innovations to ensure the innovators benefit from them, the support that innovators get from their countries to promote their innovations and position them regionally and globally (Goh, 2005). Protection of ICT innovation through Intellectual Property Rights, enhancement of Intellectual capital and knowledge are all strategic aspects key in the growth of a business whose life-blood is generating new innovations (Sveiby, 2001).

2.2 IP theories

So, what exactly is IP? Broadly speaking, the term IP refers to unique, value-adding creations of the human intellect that results from human ingenuity, creativity and inventiveness (Javorcik, 2004). An IP right is a legal right, based on the relevant national law encompassing that specific type of intellectual property right. This has enabled the granting of property-like rights over such new knowledge and creative expressions of mankind, which (Granstrand, 1999) have made it possible to harness the commercial value of the outputs of human inventiveness and creativity. This is usually done by orderly use, exchange or sharing knowledge and information by businesses in a complex network of strategic and business relationships. Such networks generally work harmoniously during the new product development process for creation and marketing new and improved goods and services in domestic and export markets (Lerner, 2002).

The grant of a property right by the government, though for a limited period of time, over useful intangible intellectual output provides the owner of such legal property rights the right to exclude all others from the commercial benefits accruing from exploitation of the right (Javorcik, 2004). The legal rights prohibit all others from using the underlying IP asset for commercial purposes without the prior consent of the IP right holder (Lerner, 2002). The different types of IP rights include patents, trade secrets, trademarks, copyright and related rights (Javorcik, 2004).

Serenko and Bontis (2004) argue that IP refers to a loose cluster of legal doctrines that regulate the uses of different sorts of ideas and insignia. Copyright law protects various 'original forms of expression', such as musical compositions, novels, movies as well as computer software programs (Sandelowski, 1986). Patent law protects inventions and some kinds of discoveries. Trademark law protects words and symbols that identify for consumers the goods and services manufactured or supplied by particular persons or firms (Serrat, 2011). Trade-secret law protects commercially valuable information such as formulae of soft drinks as well as confidential marketing strategies that companies use to conceal from their competitors. The 'right of publicity' protects celebrities' interests in their identities and images (Sandhusen, 2000).

According to (Sakakibara and Branstetter, 2001), the cultural and economic and importance of this collection of rules has rapidly increased with the growth of innovations and new developments of new products. The fortunes of many firms and businesses largely depend on intellectual property rights (IPRs) (Sandelowski, 1986). A large and growing percentage of the legal practitioners specialize in intellectual-property disputes and there is a global frenzy to revise intellectual-property laws to keep pace with innovations. Due to this growth, scholarly interest in this field has risen dramatically and articles

deploying ‘theories’ of intellectual property have proliferated (Serenko and Bontis, 2004), which has led to the development of four main approaches and theoretical writings on IP (Bader, 2006)

The first is a utilitarian guideline that lawmakers’ beacon and anchor when thinking through and shaping property rights, which, is the ‘maximization of net social welfare’. The second, anchored on the propositions that a person who labours upon resources that are either un-owned or ‘held in common’ has a natural property right to the fruits of their efforts – and that the state has a duty to respect and enforce that natural right. The third, premised and loosely derived from (Kant and Hegel, 2010) that private property rights are crucial to the satisfaction of some fundamental human needs and policymakers should strive to create and allocate entitlements to resources in the fashion that best enables people to fulfill those needs. The last is rooted in the proposition that property rights in general – and IP in particular can and should be shaped so as to help foster the achievement of a just and attractive culture (Bader, 2006).

Each of these approached indicated that the legal right is brought into existence when the requirements of the relevant IP law are fully met and it is granted or registered after following a prescribed procedure under that IP law. In most countries in the west, the national legal systems of intellectual property rights have evolved over the last one hundred and fifty years (Granstrand, 1999).

2.3 IP and innovation

Eaton, Kortum, and Lerner (2007) posit that there are many players involved in facilitating the market success of an innovation hence the effective use of the tools of IP will play an important role in reducing risk for the players involved (Sveiby, 2001), who may then be able to reap acceptable returns for their participation in the process. IP plays an important role in facilitating the process of taking innovative technology to the market place (Kanwar and Evenson, 2009). At the same time, IP plays a major role in enhancing competitiveness of technology-based enterprises, whether such enterprises are commercializing new or improved products or providing service on the basis of a new or improved technology (Kanwar and Evenson, 2009; Sveiby, 2001; Pisano, 2006).

For most technology-based enterprises, a successful innovation results in a more efficient way of doing things or in a new commercially viable product. The improved profitability of the enterprise is the outcome of added value that underpins a bigger stream of revenue and profitability (Passi, 2014).

According to (Granstrand, 1999), the IP systems of incentivizing innovation are anchored on the existence of active agents, which involved in the innovation process. This implies that the stream of inventions and innovations that are created is dependent upon incentives for such agents to invent and innovate, typically

in terms of returns from their efforts. Knowledge has characteristics of a pure public good (Stiglitz, 1999) meaning that consumption by one actor does not restrict consumption by another actor or sets of actors and it is difficult to exclude other actors from using the good. The non-excludability leads to investors in R&D, technology, and innovation to having problems with reaching positive ROIs.

Information is a commodity with peculiar attributes, particularly the achievement of optimal allocation of such information. Any information such as a new method of production that is obtained should be available free of charge apart from the cost of transmitting such information. This ensures optimal utilization of the information but provides no incentive for further investment in research. (Arrow, 1962).

Profits from innovations are (Levin, 1987) likely to end up with holders of complementary assets when imitation is easy, rather than with the inventing agent (Teece, 1986). Underinvestment in R&D and innovation then occurs due to this market failure (Demsetz, 1967; Mansfield, 1977; Levin, 1987). Considering the importance and potential of technological developments for economic development and growth, countries try to incentivize technology and innovation investments through various methods and means. IP systems are constructed to make technical and technological knowledge temporarily excludable, hence enabling innovators to properly generate and appropriate reasonable returns from their investments and therefore assist in incentivizing the generation and diffusion of inventions. This becomes a utilitarian and consequentialist, justification of the patent system. By contrast however, deontological justifications which are based on moral rules and rights of IP systems suggest that an innovator should have the right to reap benefits from his or her own labour and that one should have the rights related to their own personality or identity (Granstrand, 1999). Neoclassical economic theory from the work of Marshall (1890) is commonly used to explain the utilitarian rationale of patent systems (Scotchmer, 2004; Granstrand, 2010; Greenhalgh and Rogers, 2010).

As an illustration, when an innovator receives a patent on a technology, the society in its entirety experiences a temporary loss which is referred to as deadweight loss due to the monopolistic pricing of the innovation above the marginal cost (MC), while the innovator can make a profit thereby enabling a positive ROI. This is a sacrifice, which a society makes in order to create incentives for potential inventors not only to invest in R&D but also to disclose their inventions through patent publications. When the term of a patent ends or when substitute technologies are provided, the price of the innovation will fall closer to the marginal cost, leading to an increase in the welfare of society at large. The IP system stimulates R&D and investments in innovations and stimulates knowledge sharing and disclosure (Scotchmer, 2004).

Wright (1983) argues that an IP system is one of the ways of incentivizing development of technological innovations. The alternatives to an IP system, which are also tailored to incentivize R&D investments but not knowledge generation and diffusion and commonly used as complementary systems, include government tax incentives or reductions, subsidies, innovation procurement contracts, R&D tax credits or deductions, innovation prizes, and R&D grants and subsidies (David, 1993; Granstrand, 2003; Scotchmer, 2004; Greenhalgh and Rogers, 2010).

The IP system has received a lot of critique due to high transaction costs and monopolistic over-pricing leading to community welfare losses (Jaffe & Lerner, 2004; Bessen and Meurer, 2008; Granstrand, 2011;), and there has been suggestions that the system be abolished The consequences of abandoning the IP system are very difficult to overlook, and the following quote from the 1950s may offer an explanation.

> If one does not know whether a system 'as a whole' in contrast to just some features of it is good or bad, the safest 'policy conclusion' is to 'muddle through' – either with it, if one has long lived with it, or without it, if one has lived without it. If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it. (Machlup, 1958; Schumpeter, 1942).

Granstrand (2003) argues that the IP system design questions and parameters include: What should be protectable; how long should it be protected; how strong should it be protected; where should it be protected; what should be the cost (Gilbert and Shapiro, 1990) A general problem is that various IP systems are typically designed in a 'one size fits all' type of way (Thurow, 1997). This is problematic since various actors, intangibles, and technologies are impacted differently from the same IP system. Technologies with short product life cycles (Merges and Nelson, 1990) and low investment levels have the same maximum protection time by patents as technologies with long PLCs and high investment levels. The latter typically needs (Klemperer, 1990) longer market exclusivity to reach positive ROIs, whereby also a longer protection time would be granted. Small and medium sized enterprises (SMEs) have been shown to benefit differently from patent systems than large firms (Leiponen and Byma, 2009; Blind, 2006; de Rassenfosse, 2012).

Rockman (2004) posits that a national IP system consists of a range of various IPs, some of the most common being patent rights, trade secret rights, design rights, copyrights, and trademark rights (Koktvedgaard and Levin, 2004). The availability and design of different types of rights vary across

jurisdictions. The three typical requirements for IP protection of an invention are that it should be novel, be useful, industrially applicable and solve real and existing problems and challenges and be non-obvious (Spence, 2007).

Maskus (2000) argues that whether a business decision to innovate has been influenced by the overall business strategy such as growth through innovation or a reaction to new developments in the market place, it is imperative that an innovative idea must be treated as a secret if a business wishes to appropriate potential commercial benefits from the it. This means that the information surrounding the creation of an idea needs to be protected carefully as a trade secret (Javorcik, 2004). It should be noted that not all commercially viable ideas can be or will be patented and it is important to treat such ideas as trade secrets, particularly at the inception stage (Mataloni, 1995).

Subramaniam and Youndt (2005) argue that empirical evidence shows that, generally SMEs are more inclined to use trade secrets rather than patents as a form of protecting their innovations to stay competitive. The main reasons include high costs and complexity of the patent systems. Eaton, Kortum and Lerner (2007) posit that a study on patenting activity in Australia in 2005 indicated that twenty six percent of the firms used patents while seventy four percent used trade secrets as a way of protecting their ideas. It also showed that size was an important factor in determining the propensity to patent. Thirty five percent of small firms with less than twenty employees used trade secrets, while seventy five percent of firms with more than five hundred employees patented their knowledge (Eaton, Kortum, and Lerner, 2007; Domeij, 2003).

Further (Etzkowitz, 1993) argues that patenting-related costs and complexity of the patenting process especially relating to ‘prior art’ search and to the drafting of patent claims has been seen to hamper innovation, particularly, for cash ‘strapped’ SMEs. It is also equally true that if used strategically in a patent-friendly (Baumol, 2002) business environment for SMEs or in partnership with others, patents can become a dependable source of new, additional or higher revenue for SMEs (Eaton, Kortum and Lerner, 2007). For an idea that may result in a patentable innovation, the ultimate choice between the use of either trade secret or patent for protecting an innovation should be seen as a strategic business decision that should be taken only at a later stage of its development when all the requirements of patentability are met, namely, statutory subject matter, novelty, inventive step and non-obviousness, capable of industrial and commercial application, and adequate disclosure (Kanwar and Evenson, 2009).

At that stage, the choice between patent and trade secret would depend on the nature of the innovation, its business potential, the nature of competition, the possibility of its independent creation by competitors

and the ability of competitors to reverse engineer it easily, from the product developed (Javorcik, 2004). It should, however, be pointed out that whatever the ultimate decision, initially it is advisable that it is protected as a trade secret so that, later on a part of it may be patented (Hanel, 2006) and the rest of it may still remain as the associated trade secret and know-how, or tacit knowledge owned by individuals that are associated with the patent (Goh, 2005).

Smith (2001) posits that technical drawings, which are in most cases part and parcel of technological innovations, are protected as trade secrets or by copyright. It is important for the drawings to be dated so as to establish the date of creation. Technical drawings could also, at a later stage, form an important part of the relevant patent application (Suciu and Ghitiu-Bratescu, 2009).

Goh (2005) is of the view that the information contained in existing patent documents known as patent information plays an important role in the conception, screening and development of an idea. According to (Teece, 2009), such information can provide useful insight on whether an idea is new or not and whether to proceed further in developing an idea. Furthermore, proper analysis of patent information may provide an insight into the strategy of potential competitors and about technology trends (Smith, 2001), (Pisano and Teece, 2007).

2.4 IP laws and enforcement

IP laws govern the ownership and accessibility of innovations (Chon, 2006), ideas and inventions on tangible and intangible concepts. The laws also deal with the rules for enforcing and securing legal rights to innovations and designs to ensure exclusive use and control of intangible assets (Kennedy, 1982) by the IP holder. IP is an integral part of business (Jean-Frederick, 2014) in a very competitive world and IP laws incentivize innovators to develop innovation and creative works that are of benefit to society without the fear of misappropriation of such innovations by third parties (Fisher, 1998).

Sherman and Bentley (1999), say that IP give innovators the right to use their innovation in the marketplace (Hess and Elinor, 2003) and to profit from its use or by transferring that the IP. IP protection is not available for theories or ideas, or anything that has not been captured in a fixed medium. Infringement refers to the unauthorized use of IP and for protection against such infringement IP owners would take steps to put the ‘world on notice’ that their IP rights exist (Stokes, 2001). Providing notice deters any infringement by making the IP owner’s rights more clear and visible to third parties that might inadvertently violate them. Protection triggers additional legal benefits, and puts the IP owner in a better position (Kelvin, 2013) to prosecute an infringement in court, should it become necessary. Where infringement occurs, IP rights can be enforced in court through the application of IP laws (Adam, 2014).

There are different ways of protecting the ownership of innovations, ideas, products or concepts, which come in the form of patents, trademarks or copyrights. Such protection is anchored in law, by IP law (Cutler, 2008). Much of an IP law's activity involves legal advise on use, commercial viability, distribution and marketing channels and mechanisms, duplication and infringement, vesting of usage rights and ownership of an innovation, idea, concept or product which falls within the per view of IP. IP laws have contentious and non-contentious components (Goldstein and Reese, 2008).

For an IP lawyer, activities include issuing of notices to parties in the event of infringement of a client's rights (Bettig, 1996), looking through patent registries in relation to new innovations, ideas or products brought forward by clients. Implementation of IP laws requires an IP lawyer to initiate discussions between parties and challenge decisions and rulings that might go against your client's interests (Sahu and MrKsich, 2004). Contracts and agreements are the lifeblood of any IP and IP lawyers counsel innovators on establishment and protection of IP. The practice of IP law spans the entire gamut of copyrights, patents, trademark, franchising, trade secrets and technology transfer (Bitton, 2012).

Through the application of IP laws, an IP grants a temporary monopoly for the exploitation of an innovation (Cutler, 2008). The IP holder acquires, for a limited period of time, the exclusive right to prevent others from using or commercializing the innovation. IP officer assesses the innovation against a number of requirements as per the law. These include the novelty, non-obviousness and industrial applicability of the innovation (Irina, 2011). The practice of the law further assists in licensing innovations, proprietary technology transfer, drafting licensing agreements, settlements negotiations and IT asset due diligence (Michele and Levine, 2008). The practice further represents clients in IP issuance agencies and extension of revision of the laws to protect new ideas or address hitherto unseen or unrecognized breaches (Stallman, 2016).

The Government of Kenya enacted into law the Industrial Property Act of 2001. Sihanya (2001) in his book 'Copyright law in Kenya' argues that Kenya's copyright law and practice have deep roots in the colonial and neocolonial experience and copyrights contribute to the socio-economic development to the extent that IP and copyright are sources of royalty and other forms of payments to their originators. IP contributes to the country's national income in the form of taxes and provide employment especially to ICT graduates. The IP doctrines do assist in the process of securing consumer confidence and quality (Sihanya, 2001). The Kenyan IP regime would however appear to lack in a number of aspects. He argues that from his research, patent and copyright owners are still incurring heavy losses due to piracy and infringement, which is as a result of several factors including lack of proper ways of monitoring IP and copyright transactions. IP and copyright owners lack the capacity and are largely left on their own to look out for the infringers (Sihanya, 2001). Many innovators are also not aware that they possess IP rights that

are valuable and hence get the mindset that IP infringement has no remedy or is necessarily permissible. Where such infringement is successfully prosecuted in a court of law, the penalties are not stiff enough to deter the vice (Sihanya, 2001).

Sihanya (2001) further argues that copyrights and IPRs, control and regulate IP and propagate 'ideology and education'. The laws do not have history of being enforced and have largely remained Western in form, substance and practice and the challenge still remains why Kenya cannot design an IP and copyright legal regime that is economically, socially, culturally and politically appropriate and one that would meet the changing information and knowledge landscape.

Dzinkowski, (2000) argues that there has been controversy on the interests of innovators, creators and authors on one hand and publishers, investors and cultural entrepreneurs on the other. New technologies such as photocopying, piracy through duplication of content on CDs, DVDs, internet publishing and electronic delivery of literary materials and knowledge have added to the challenge as has liberalization of investments and international trade.

Sihanya (2001) further avers that a national due diligence process on the process and challenges of granting IP is necessary especially by considering gap analysis, scoping and evaluations. It is necessary for innovators getting into contracts with venture capitalists, private equity firms as well as global technology firms to ensure that clauses in the contracts cover any source materials such as software source code, which should be escrowed with the necessary indemnities (Garcia and Calantone, 2002). The government could build capacity for market place audits and then take appropriate action to deter piracy and IP and copyright theft. This should also extend to rights over domain names and trademarks (Sihanya, 2001).

Suciu and Ghitiu-Bratescu (2009) argue that the way to create new strategic value in a knowledge world, is to ensure that the development and investment models are aligned with new development, research and commercialization architecture which is underpinned by new economic asset classes such as IPRs. This new asset class consists of intellectual assets - know-how, copyrights, patents, trade secrets and expertise. The new economic landscape requires a nuanced strategic economic approach with a combination of in-depth understanding of industry economics as well as business strategies that have become the new economic imperative (Javorcik, 2004).

2.5 IP rights

As already mentioned, the different types of IP rights include trade secrets, utility models, patents, trademarks, geographical indications, industrial designs, layout designs of integrated circuits, copyright and related rights, and new varieties of plants (Rockman, 2004). Manzini and Lazzarottu (2011) argue that property rights are a theoretical construct in economics for determining how a resource is used, and who owns that resource government, collective bodies, or individuals. Property rights can be viewed as an attribute of an economic good. This attribute has four broad components and is often referred to as a bundle of rights (Leiponen and Byma, 2009) which include the right to use the good, the right to earn income from the good, the right to transfer the good to others and the right to enforcement of property rights.

In economics terms, the property refers to ownership, the rights to the proceeds of output generated and control over a resource or good (Bader, 2006). Grimaldi (2014) is of the view that, the concept of property rights as used by economists and legal scholars are related but distinct. The distinction is largely seen in the economists' focus on the ability of an individual or collective group to control the use of the good (Ruggles, 1998).

Property rights according to (Brooking, 1996) must be defined, their use must be monitored, and possession of rights must be enforced. The costs of defining, monitoring, and enforcing property rights are termed costs. Depending on the level of transaction costs, various forms of property rights, appropriate institutions to provide necessary safeguards will develop. Each institutional form can be described by the distribution of rights, which are open access property, state property, common property and private property.

According to Brooking (1996), open-access property also known as *res nullius* is not owned by anyone. It is non-excludable meaning no one can exclude anyone else from using it but may be rival which means that one person's use of it reduces the quantity available to other users. Open-access property is not managed by anyone, and access to it is not controlled. There is no constraint on anyone using open-access property and excluding people is either impossible or prohibitively costly the atmosphere or ocean fisheries are perfect examples (Ruggles, 1998).

Open-access property may exist for several reasons; because ownership has never been established, because the state has legislated it, or because no effective controls are in place, or feasible - the cost of exclusion outweighs the benefits (Brooking, 1996).

Grimaldi (2014) posits that IP rights are the rights given to persons over the creations of their minds. They usually give the creator an exclusive right over the use of his/her creation for a certain period of time. IP covers a wide number of areas and may cover names, technical innovations, visual signs, works of fine art and useful creations among others (Manzini and Lazzarottu, 2011). The first step is to determine which IP right is likely to be applicable to a particular object. Each of the rights corresponds to a different set of rules: the cases which, require authorization are different; the conditions for obtaining a patent are different from those of copyrights. The same applies for duration of protection or administrative formalities. (Brooking, 1996).

2.6 IP management

IP management assures the access to and maintenance of exclusive rights (Marr and Adams, 2004) and grants creative authors such as writers, artists, musicians and scientists a way to protect their original work and the opportunity to promote their work professionally without fear of their ideas being stolen or not receiving proper credit (Sveiby, 2001).

For technological innovations, innovators need to identify new opportunities and also exploit current and previous opportunities (March, 1991; Teece, 1997; Teece, 2006). The strategic management of technological IP leads to the formulation and execution strategies related to technological IP (Davis, 2008), including methods of acquiring and creating IP, how to govern and exploit IP and commercialization and extraction of value from IP. IP management is central to both the exploration and exploitation of opportunities (Lichtenthaler, 2010) and it is applied in making a distinction to operational IP management (Teece, 2006; Mintzberg and Waters, 1985) define strategy as ‘a pattern in a stream of decisions’ and together with (Mintzberg, 1978) they have emphasized that strategies lie on a continuum between deliberate and emergent strategies. Deliberate strategies are patterns of decisions realized as intended (March, 1991), while emergent strategies are patterns of decisions realized despite or without intentions (Mintzberg and Waters, 1985) and hence the realization that on one hand strategies are not always deliberate, and on the other hand deliberate plans that do not always lead to a pattern of decisions according to the plan, (Teece, 2009).

Porter (1980) describes competitive strategy as ‘taking offensive or defensive actions to create a defendable position in an industry and in the process yield a better return on investment. Relating IP management to this, two different aims of IP can be identified (Granstrand and Oskarsson, 1994). The first one is an offensive aim, is to ‘block competitors from using a technology and in so doing increase their costs and time for imitation and/or for inventing around the IP (Bogers, 2012), in order to increase

willingness of competitors to pay for a license or to stay out of a market and hence ensure market freedom for the IP holder (Somaya, 2011). The second is a defensive aim, to block the competitors from blocking oneself, and thereby ensure design freedom (Granstrand, 1999). The offensive aim then relates to both proprietary strategies, in which the IP holder tries to obtain exclusive position in a technology, and leveraging strategies (Davis, 2008), in which the patent holder tries to get other direct or indirect benefits from the IP, for instance through licensing to generate revenues or through cross-licensing to access other resources (Somaya, 2012).

Developing IP management as a core competency involves much more than securing the right legal protection (Davis, 2008). It involves adopting the suitable IPR strategy for competitive positioning, and exploitation of the IP rights in integrated markets (Subramaniam and Youndt, 2005).

The mentioned competencies cannot be developed without the support of the right organizational (Laursen and Salter, 2006) culture. Many surveys and reports have shown how the best knowledge, innovation, and IP management programs fail because of an adverse organizational culture (Sveiby, 2001). Organizational culture is the set of shared unspoken values that stem from the organizational philosophy and history (Harris, 1998), and affect its behavioural patterns. It implicitly defines and affects the way business is done and the attitude of management and other employees. It was discovered that whenever an organization's culture is contrary (Moran and Ghoshal, 1999) to the values presented by a new initiative or program, the latter fails, sometimes even before it is fully launched (Subramaniam and Youndt, 2005).

Globalization and technological revolution challenged the principles of the world economy at the beginning of the twentieth century (Bader, 2006). The computer and the Internet initiated the transformation of social relations in the direction of the information era (Levi-Jaksic, 1995; Harris, 1998). Fast and affordable electronic communication worldwide provides an easy access to information and transforms it into active knowledge (Grandstand, 1999), but also enables an efficient performance of business transactions, such as the provision of various services regardless of the geographic distances (Grandstand, 1999). As a response to these changes, many governments started investing significant efforts in the development of competitiveness of their economies and supporting innovativeness, education and research (Kanwar and Evenson, 2009).

Intellectual assets are goods, which at first must be created, ‘produced’, and then commercialized (Grandstand, 1999; Bader, 2006). Such commercialization takes place under legal conditions necessary

for appropriation of profit for and economic utilization IP (Cowan and Harrison, 2001). Soft IP, go to market, market lead-time afford a company an advantageous market position which it uses to recover the investment in creating that asset in a reasonable time period, and to maintain the advantage over the competition (Al-Ali, 2003). The economic approach to IP focuses on the economic value underlying the IP, which can be materialized and appropriated only if that property is used economically, regardless of whether it is legally protected or not (Cowan and Harrison, 2001; Bader, 2006).

IP rights have several basic functions (Yang and Maskus, 2009) including to stimulate the 'production' of creations by providing a possibility of gaining legal monopoly on the economic exploitation of new intellectual creations, such as inventions and copyrights (Bader, 2006). Second is reduction of the information gap between the subjects which provide and the subjects which demand certain goods and services on the market, by securing an exclusive right for the utilization of distinctive signs such as trademarks, geographical indications of origin and industrial designs (Grandstand, 1999). This reduces transaction costs and stimulates investments for quality goods and services as well as market efficiency of the market (Kanwar and Evenson, 2009; Yang and Maskus, 2009; Bilen-Katić, 2010).

IP rights further facilitate the transaction of rights for the use of intellectual property assets and facilitate economic implementation of the protected intellectual property assets (Moran and Ghoshal, 1999). However, in the cases when the right holder has no capacity or interest to directly utilize a certain IP asset, he or she can assign or license that right to the subject, which has the capacity and the interest for doing it. The legal protection of a non-material asset and an IP asset will then find its way or lend itself to practical implementation (Yang and Maskus, 2009).

In countries like Kenya with nascent industries, IP rights serve to attract FDI (Kanwar and Evenson, 2009). In the global economy, capital searches for favourable conditions (Bilen-Katić, 2010) for doing business. Efficient legal protection of IP encourages foreign companies to import products and services based on new technologies, renowned trademarks and service marks. An efficient system of IP protection represents a constituent part of the business environment which favourably influences the development of host knowledge-based economy (Bilen-Katić, 2010), stimulates research and development projects and the development of the sector of new economy (Kanwar and Evenson, 2009; Yang and Maskus, 2009; Bilen-Katić, 2010). This provides the prescription for Kenya to follow to ensure IP security.

Other aspects of IP management include are IP operations and procedures which are important for the effectiveness and quality of IP systems, and by extension for innovation (Kanwar and Evenson, 2009). For registered IP there are procedures, which involve application procedures, examination on substance

and form, registration and grant, as well as maintenance. The digitization of the processes facilitates and speeds up IP registration procedures. International co-operation with an agency such as WIPO regarding IP procedures provides opportunities for cost-effective improvements.

IP operations and procedures are necessary for applicants and IP offices to follow in obtain or grant IP for innovations (Yang and Maskus, 2009). The procedures sequentially involve application, registration, examination, granting of IP protection and regular maintenance fees (Kanwar and Evenson, 2009). IP registration and granting procedures have impact on innovation and may raise IP policy implications. Where high quality IP procedures are not established, the IP titles do not meet legal standards, which places high and undue barriers for innovators (Bessen and Meurer, 2005).

Educating, informing and changing attitudes about IP, builds respect for IP (Yang and Maskus, 2009). Several activities are necessary in raising awareness, and these include campaigns, road shows, conferences, TV and radio documentaries as well as publicity materials disseminated through the social media. Raising awareness is essential for building IP knowledge (Bessen and Meurer, 2005).

The necessary tactics for education and awareness include but are not limited to IP incorporation in the education curricula, strategies to encourage legitimate consumption of IP protected goods and services, technical measures to prevent access to infringing content and enforcement that is associated with awareness raising campaigns (Bader, 2006). Several players are necessary in providing the education and awareness and include IP offices, government ministries, schools and universities, chambers of commerce, IP-related trade associations and business, civil society such as NGOs, consumer and professional associations and legal professionals. The media through newspapers, TV and radio, web sites, social media also plays a very key role (Bessen and Meurer, 2005).

2.7 IP and competition

IP being a business tool is used to attain innovation, value creation and competitive advantage (Amra, 2008). IP designates boundaries within which competitors may exercise legal exclusivity (monopolies) over their innovations (Boldin, 2008). In terms of competitive practices or monopolistic tendencies, an anti-competitive practice is defined as any practice that has, is intended to have, or is likely to have, the effect of restricting, distorting or preventing competition. As IPRs provide exclusive rights to the inventors or creators of that property, there create anti- competitive practices, which are practices or conditions that may constitute abuse of IPRs with an adverse effect on competition in the relevant market (Arundel, 2001).

Boldrin (2008) argues that the IPRs can produce undesirable effects on social and economic sectors of a country. IPRs are considered negative in nature in the sense that they are capable of creating monopoly power in the fields of design, production, marketing and distribution. The right owners have the potential to act contrary to the rules of competition and public interest. There are therefore anticompetitive trade practices associated with IP and which need to be regulated for their negative effect and impact on public interest through abuse of fair competition rules (Coombs and Bierly, 2006).

According to (Greenhalgh and Rogers, 2006), IP gives the creator an exclusive right over the use of his creation during a certain period of time, allowing the owner to prevent un-authorized use of its IP and to exploit it by, *inter alia*, licensing it to third parties. However, when exercise of IPRs appears to cross certain lines, it undermines and infringes other rights and laws with negative effect on the public good (Hanel, (2006). Competition and monopolies laws and IP are based on the similar economic rationale. They are crucial for the establishment of competitive and innovative market conditions.

IP provides short-term monopolies, which implies there are specific incentives for the innovator (Arundel, 2001). After the duration is over, the IP monopoly expires and falls in public domain. In the absence of this protection imitators could exploit the efforts of innovators and investors without compensation (Hanel, 2006).

2.8 Innovation, knowledge workers, knowledge management and job creation

Innovative activity requires a wide range of knowledge, skills and competence (Amar, 2004). General and digital literacy, cognitive abilities and skills, soft skills in team work and team building. Innovation is characterized by ever increasing and high demand for integrated combination of skills which requires human resources that are self driven in their work and acquiring new knowledge (Maruta, 2012).

Knowledge is created through the knowledge worker's creative and mental activity, which involves the interaction of important insight, information and knowledge (Arthur, 2008) leading to job creation for knowledge workers. Knowledge workers augment their capability to exploit information and knowledge through their personal learning efforts and through access to appropriate external knowledge and information sources provided by their employers or the environment in which they work (Karr-Wisniewski, 2010). Knowledge workers with good insights have the awareness and capability to innovate and know that innovations are necessary for the success of a business (Maruta, 2012). Knowledge work goes hand in hand with teamwork, which is crucial for innovation and knowledge companies, which must constantly innovate and create new knowledge (Mutlu, 2015).

Compared to traditional businesses, innovatively active firms hire skills (Mutlu, 2015) in software and database development. Such human resource forms the backbone of the innovation economy through job creation. Knowledge workers are therefore defined as ‘those who work on the basis of knowledge and through knowledge and are capable on the basis of their knowledge to create new knowledge, products, concepts and methods’ (West, 2012) who also argues that knowledge workers make up a significant proportion of the workforce of advanced economies.

Gilson (2004), argues that the emergence of the knowledge capital from investment in intangible assets, computerization information and organizational capital has led to the growth in number of knowledge workers who create new knowledge for their employers (Karr-Wisniewski, 2010), who in turn assure the workers of career growth anchored on growth of the business and the economy in which the firm is anchored. The protection of IP serves to attract knowledge workers to the innovation sector (Adam and Roncevic, 2003).

The nature of innovation involves complexity and uncertainty since the knowledge workers’ job is to solve complex problems and deal with ambiguity. These workers have high-level autonomy and work in self managed teams. Knowledge worker teams develop their own innovation team processes to guide their innovation work. The processes include communication, trust development, absorptive capacity, cognition and creative abrasion, which increase innovation teams performance (Schippers, 2012). The management`s role is to facilitate and improve the working conditions of these workers (Mutlu, 2015).

In addition, Kanwar and Evenson (2009) argue that the number of knowledge firms globally continues to grow, buoyed by the growth of the internet and hand held devices that increase internet access and growth in relevant skills. These organizations sell the knowledge and know-how of their employees – the knowledge workers, which increases knowledge transfer. Such knowledge transfer is anchored on one firm innovating and creating new knowledge that other firms need. Even those businesses that do not have 'sale of knowledge' as their primary function still have a high rate of internal distribution of knowledge, to assist them to survive and grow. (Adam and Roncevic, 2003).

Hayes and Walsham (2003) are of the view that knowledge cannot be totally managed but can be organized in an effective way that allows easy storage and retrieval. Being able to direct staff and resources to a precise result is not so easy especially being dependent on available software and the ingenuity of those working with the software (Goh, 2005). A better approach for organizations rather than managing knowledge may be to adopt a 'knowledge focus' or be involved in 'knowledge creation'. These terms reflect what can be done in a business in a meaningful sense by stating that the business is seriously

interested in knowledge and takes an organized and focused view to making the most of knowledge in which it deals. (Adam and Roncevic, 2003).

In his research, Passi, (2014) argues that no matter what a business does to capture the knowledge of its employees, the exercise will always be an incomplete one. The software developer who writes high quality programs dispenses some of his/her knowledge in the work produced. However, if that person goes to another organization there is no guarantee that the same quality of work can be carried on by the remaining staff. In addition, the software developer can pass on the knowledge gained to the next employer or client. (Adam and Roncevic, 2003).

Similarly, Hayes and Walsham (2003) describe content and relational perspectives of knowledge and knowledge management as two fundamentally different epistemological perspectives. The content perspective suggest that knowledge is easily stored because it may be codified, while the relational perspective recognizes the contextual and relational aspects of knowledge which can make knowledge difficult to share outside of the specific location where the knowledge is developed (Hulme, 2009).

Mahoney and Pandian (1992) argue that research suggests that a successful knowledge management effort needs to convert internalized tacit knowledge into explicit knowledge in order to share it, but the same effort must also permit individuals to internalize and make personally meaningful, any codified knowledge retrieved from the knowledge management effort. Subsequent research into knowledge management suggested that a distinction between tacit knowledge and explicit knowledge represented an oversimplification and that the notion of explicit knowledge is self-contradictory. For knowledge to be made explicit, it must be translated into information. (Serenko and Bontis, 2004). It is worth noting that geographical proximity between knowledge workers, which leads to the formation of social relationships that make it easier to transmit tacit knowledge and it leads to development of innovation clusters, which are critical for further growth of innovation.

2.9 Resource based view (RBV) of organizations

The RBV approach is an emerging framework that has stimulated discussion between scholars from three research perspectives. First, the resource-based theory incorporates traditional strategy insights concerning a firm's distinctive competencies and heterogeneous capabilities (Fahy and Smithee, 1999). The resource-based approach also provides value-added theoretical propositions that are testable within the diversification strategy literature. Second, the resource-based view fits comfortably within the

organizational economics paradigm. Third, the resource-based view is complementary to industrial organization research. (Barney, 1991).

RBV as a basis for the competitive advantage of a firm lies primarily in the application of a bundle of valuable tangible or intangible resources at the firm's disposal (Penrose, 1959). To transform a short-run competitive advantage into a sustained competitive advantage requires that these resources are heterogeneous in nature and not perfectly mobile. Effectively, this translates into valuable resources that are neither perfectly imitable nor substitutable without great effort (Barney, 1991). If these conditions hold, the bundle of resources can sustain the firm's above average returns. Looking at IP and innovation with an RBV lens, one can say that IP is a key resource for any organization (Mahoney and Pandian, 1992).

To capitalize on IP, an organization must be swift in balancing its innovation activities and such a balancing act requires changes in organizational culture, technologies, and techniques. A number of organizations believe that by focusing exclusively on people, technologies, or techniques, they can manage the innovation process (Hunt, 2013). However, that exclusive focus on people, technologies, or techniques does not enable a firm to sustain and use innovation and IP as its sole source of competitive advantage. (Grandstand, 1999). It is, rather, the interaction between technology, techniques, and people that allow an organization to manage its knowledge effectively. By creating a nurturing and 'learning-by-doing' environment, an organization can sustain its competitive advantages. (Penrose, 1959).

The Resource Base Theory (RBT) uses resources as the central unit of analysis. Penrose (1959) argues that a firm consists of productive resources being administered in order to render services useful to the firm. The combination and synergies of material resources and human resources enable unique services, leading to competitiveness of firms (Chandler, 1990; Penrose, 1959). Being more concerned with growth than size of firms, Penrose (1959) argues that unused resources direct the expansion of firms, while available managerial resources limit the growth.

Itami and Roehl (1987) emphasize the role of 'invisible assets or resources', such as experience, information, technologies, brands, reputation, and culture, for firm competitiveness. Such invisible resources require time, money, and conscious efforts to build, and are often not easy to buy 'off the shelf' unless through mergers and acquisitions (Wernerfelt, 1984). Due to the difficulties in building and trading them, invisible and intellectual resources are an important source of firm differentiation and competitive advantage, and therefore controlling corporate, environmental and internal information flows is core to successfully building invisible resources (Itami and Roehl, 1987).

Resources as the tangible and intangible assets a firm uses to choose and implement its strategies (Barney, 2001). A competitive advantage exists when a strategy for creation of value is implemented by a firm without simultaneously being implemented by any current or potential competitors (Barney, 1991). A sustained competitive advantage is then a competitive advantage that the current or potential competitors are unable to duplicate (Barney, 1991). The value of a competitive resource can be assessed via suitable frameworks for the resource's value, cost to imitate, rareness and its potential exploitability by the firm (Barney, 1991; Barney and Hesterly, 2005).

2.10 Innovation appropriation strategies

Competition at the global level and the ever-changing innovation and creativity has continued to change the way countries, companies and individuals create value (Sveiby, 2001). There is always a metamorphosis of structures, approaches and perceptions and intellectual capital plays a key role in this (Edvinsson and Malone, 1997).

The word innovation does offer a number of definitions based on the field of study under consideration. It can be a change sensed by a user, a comprehension of novelties that have materialized into services, methods or goods. Souder (1984) argues that innovations spur growth and economic impact and are also high risk in terms of resources based on the probability for success and subsequent scaling up which is not always guaranteed. Betz (1987) posits that innovation introduces new methods based on new technologies and innovation is an economic concept since it refers to and relates to the commercial appropriation of refinements and inventions of services and goods that people utilize. In strategic terms, Porter (1993) argues that it is not only technologies but methods and processes that should also be critically considered as ingredients of innovation (Koktvedgaard and Levin, 2004).

Schumpeter (1988) argues that innovation refers to production of things differently and efficiently and thereby accelerating and inducing economic growth which goes further to stimulate more innovations. Innovation leads to effective utilization of technological and scientific developments. Freeman (1982) avers that innovations is likely to be confused with invention, but it goes further than invention since it extracts the commercial value by scaling up of ideas.

Goh (2005) argues that innovations become a source of capital, when they are protected by appropriate laws on copyrights and patents. Organizations or individuals then leverage on such protection to create intellectual capital (IC) and IPRs (Lai, 1998).

In the global context, three types of innovations can be discerned. These include improvements based on technology adoption, building up competitive activities that have some adaptation to existing technologies and design and production for technologies that would appear to have global significance (Keller, 2004). The development of competitive industries requires adaptation of technologies that are available locally and globally. It is however necessary to be keen on innovating and continual improvement in the light of competition and the need to successfully scale the innovation to commercial levels as well as climbing the value chain and improving on marketing, quality, logistics and organization (Sveiby, 2001). The potential and scope of the innovations is also used to determine the value of Foreign Direct Investments (FDIs) to a country since FDIs are increasingly sensitive to quality of business environment and size of domestic and export market (Keller, 2004).

According to (Echambadi and Campbell, 2006), businesses need to acquire databased and intangible wealth, which has historically increased the role of information and related technologies. Creation of analytical processing and business analytics has a role in development of intellectual capital in an organization. Brookings Institute in a research carried out in 2005, found out that land, supplies and factory assets constitute less than thirty percent of the company value, while information and knowledge based assets make up more than seventy percent. A study carried out by (Dzinkowski, 2000), executives consider intellectual property and data to be the most strategic resources of an enterprise.

In Kenya, there exists Communities of Innovations (CoI), which are ecosystems that provide innovators with the environment to dream, build and actualize their ideas. Examples of such CoIs, also known as accelerator services and incubation labs include iHub, iLab Africa, Nailab among others. They access to knowledge sources, expert advise in business planning and mentorships for innovators to develop their ideas into commercially viable services (Thurow, 1997).

According to (Somaya, 2012), innovation activities lead to creation of something new and useful. Most innovators however are not only concerned with value creation, but also with capturing a share of that value. The ability to capture returns from R&D investments is referred to as appropriability (Levin, 1987; Teece, 1986). Appropriability has a relationship not only with legal impediments such as patents and copyrights, but also to the nature of the technology including products and processes, which are either tacit or codified (Teece, 2006).

In the case of ‘tight’ appropriability where imitation is difficult or impossible, because of a patent, the innovator will likely collect a large share of profits from innovation. By contrast, when imitation is easy,

access to complementary assets is core to gaining returns from innovation (Teece, 2006). Teece (1986) argued that tight appropriability regimes are not common, and that controlling complementary assets is at the core for innovators to appropriate suitable positive returns from innovation. However, (Teece, 2006) has identified that appropriability is not exogenously given in an industry, but can be endogenously shaped by innovator firms, governments, universities and technological change itself (Granstrand, 1999; Pisano, 2006; Pisano and Teece, 2007; Somaya, 2012; Teece, 2006).

The works of (Dahlander and Wallin, 2006), have emphasized that tight appropriability is not necessarily always most conducive for firm profitability (Pisano, 2006), especially in industries where innovation is cumulative and complementary (David, 1993; Teece, 2009). The fact that the appropriability can be endogenously shaped means that appropriation strategies are important for enabling firms to gain returns from their innovation investments (Teece, 2009).

Levin (1987) argues that the relative effectiveness and importance of various means and strategies of protecting the competitiveness of new products and processes is a key factor in appropriation. The effectiveness of different means of innovation protection and hence appropriation, varies widely across industries. Patents are typically more effective for product innovations than for process innovations (Granstrand, 1999; Levin, 1987).

In addition to tight innovation appropriation supported by IP, innovators rate other aspects such as volume of sales and post sales support, first to market lead times, continuous learning and cost reductions as very important indicators of the value of their innovations (Leiponen and Byma, 2009; Levin, 1987). The various appropriation means are not mutually exclusive and go to market lead-time can be prolonged by IP protection as well as superior after sales service and support (Dahlander and Wallin, 2006; Pisano, 2006).

2.11 Innovation theft and loss

Technological innovation enables innovators to tap into huge business possibilities as well as growth (Thorpe and Gamman, 2009). With such growth, businesses start to look for new markets and new partners to increase the coverage of the innovations (Lindskog, 2001). As such innovations proliferate and consumer demand grows, so does IP theft supported by cyber attacks, become real threats to the innovations (Thorpe and Gamman, 2009).

Cyber insecurity is increasingly becoming a threat to technological innovations and targeting and accessing new markets by innovator firms is increasingly being hindered by the ever-growing cyber threat (Atkinson, 2011).

Cohen (2011) argues that the loss of innovation may result from lack of adequate protection of such innovations and according to (Olander, 2014), such theft of ideas and innovation for financial gain by third parties has minimal or no input in developing the innovation. The world is replete with losses or theft of innovation (Sanidas, 2014).

The innovators suffer loss of sales and competitive advantage (Cohen, 2011). They suffer loss of goodwill, brand prestige and can be viewed as organizations or individuals that cannot effectively manage their stock of knowledge. Where firms seek to monitor infringers of their innovations, they incur high costs of building a case especially for potential legal action (Olander, 2014).

2.12 Innovations and economic growth

Technological innovations have become important contributors to economic general wellbeing and the nations of the world are increasingly becoming more open and increasingly interdependent (Grossman, 1993). Communications and collaborations among technology innovators in different countries facilitate innovation and the spread of new ideas. Innovations therefore lead to productivity and global competitiveness, which leads to efficiencies and increase in global wealth (Helpman, 1993).

Abramovitx (1995) has argued that innovative activity is the single, most important component of long-term economic growth for countries and the entire globe. In a most fundamental sense, there are two ways of increasing the output of the economy - increasing the number of inputs in the productive process, or thinking of new ways of getting more output from the same number of inputs (Abramovitx, 1995). Abramovitz (1995) conducted research covering the American economy between 1870 and 1950. His focus was on growth in inputs both capital and labour, considering the assumptions on how much a growth in a unit of labour and capital should add to the output of the economy (Sanidas, 2014). He concluded that the measured growth of inputs - capital and labor between 1870 and 1950 could only account for about fifteen percent of the actual growth in the output of the economy. In a statistical sense, then, there was an unexplained residual of not less than eighty five, which he attributed to new form of growth outside of proportionate increase of labour and capital (Cohen, 2011).

The role of innovation has been and continues to critical to be economic development of nations over the decades (Cohen, 2011). Cohen (2011) further argues that there is a clear statistical link between innovation and gains in the standard of living across nations. Technology advances have spurred new products and evolvement from agrarian economies, many economies of the West have advanced from emerging nation status in the mid-19th century to technological and industrial powerhouse in the Twenty

first century. Importantly, conscious government polices have helped ease the difficult transition to technology enabled work processes (Sanidas, 2014).

2.13 IP alternatives

Scherer (1984) emphasizes that there are many alternative approaches to IP based on communal, sharing and open access innovation. In certain environments, lump-sum prizes, are offered as incentives to innovative activities to remove the barriers of access to such technology especially if it is a public good. Penrose (1951) argues that ideas by their nature cannot be confined or exclusively appropriated and innovations cannot be subjects of property and the interactive and cumulative nature of technological innovation and progress may preclude the competitors making socially useful innovation (Li, 2009).

Levin (1987) further argues that a winner-takes-all approach creates an all-out competition that more often than not results in duplication of investments and efforts. He further argues that resources are wasted in efforts to get around existing patents, rather than to create genuine new knowledge.

Scherer (1984) argues for a flexible system of compulsory licensing, where the IP holder bears the burden of demonstrating why the IPR should not expire or be licensed at modest royalties to all applicants three or five years after its issue. This is because the IP holder by the third year possesses substantial market share and licensing other players for the same technology is for the general public good.

According to (Hertzfeld, Link and Vonortas, 2006), the traditional IP protection has with time become woefully inadequate because most IP laws are creatures of the pre-information age. As the deficiencies of traditional IP protection continue to be perceived, different forms of IP protection have begun to gain currency, these include supplementing and supplanting traditional IP systems with taxation, online contracts for online transactions, protection through encryption especially for access to online content or services. The open source model, which propagates the need to share, build on the work and innovations of others and co-create with others online and earn royalties on their work as others will pay royalties by building on an innovator's work (Kim, 2002). The efficiency of the open source model in coordinating collaborative creativity and facilitation of an environment that is conducive to collaborative production of innovations is therefore enhanced (Coombs and Bierly, 2006).

2.14 IP policy and practice challenges

IP policy and IP management underpin the preservation and enhancement of the operational value of IP as well as IP commercialization and dispute resolution mechanism. Incoherent IP policies are brought about by several IP agencies, which work at cross-purposes and their roles overlap (Selgelid 2008). IP and anti

competitive practices, loop-sided contracts intended to raise the barrier to IP access, geographical and territorial restrictions, demand for royalty pre-payments before access to IP products and services, demand for purchase of maximum quantities even when a consumer or client needs less quantities, limiting use of IP to a certain field and not others hence making it expensive, fixing minimum retail price, tie-in buy clauses that requires a buyer to buy additional products/services unrelated to the purpose for buying patented products all contribute to the challenges to the political, legal, economic and legal environments (Pogge, 2005).

With the great potential and value of IP comes the possibility for theft and infringement, requiring strengthened enforcement to protect IP. The challenges related to protecting and promoting IP are complex, and these challenges can best be addressed by improving the understanding of the entire ecosystem of IPR—including governments, the private sector, and the general public (Ravvin, 2008).

The complex interrelationships between economic growth, technological change, economic and social circumstances, public policy and trade underpin, IP protection and act as a competitive boost to innovation and growth. There is therefore a greater context in the belief that IP promotes development through greater creativity, innovation, and technology transfer.

In terms of competition and IPs, countries need to determine as a matter of policy and practice whether competition regulation should emphasize fairness over efficiency (Reichman, 2009). Efficiency sees competition law and IPs as complementary means of encouraging dynamic competition through innovation. Fairness highlights consumer access and technology diffusion.

Most developing countries are net importers of technology and are likely to favour an access orientation (Sengupta and Dube, 2008), which would however work against the gains envisioned by IPs. For developing countries, establishing and enforcing competition law is technically demanding and subject to numerous economic uncertainties. In this context, developing countries may need to pursue a limited strategy for IP-related competition policy (Janis 2005). Few developing countries can afford to devote the administrative and legal resources needed to study goods and technology markets for adverse effects of behavior on competition and make the case for policy remedies.

An aggressive competition enforcement on IPs may have a debilitating influence on a country's investment climate. Such widespread action could induce developed countries to push for global policy and standards on IP-related competition rules. Such a demand could result in adverse outcomes from the

standpoint of developing countries and place further stress on the trading system and country economic growth plans (Love and Hubbard, 2007).

2.15 Tensions, contradictions and unresolved issues

The IP regime and formal product and service standardization are key institutions in the changing frame of the innovation ecosystem. IP and standards are inherently complementary but the relationship between them has become increasingly tense as the use and the conditions of use of each, has changed during the past two decades (Tirole, 1988). Their 'co-evolution' and economics of technological change have brought patenting into a collision course with formal standardization activities, with increasing number of conflicts. There have been attempts to provide solutions at different levels: at the institutional level (IP policies), at the policy level (areas of competition, completion laws, IP, and standardization policy), and in other contexts (patent pooling and other licensing schemes).

IPs tend to be seen predominant in terms of their contribution to the 'incentive structure' and less for their role of distributing information about innovations. In contrast, the role of standardization is to work in the collective interest of all. Schmidt and Werle (1998) argue that the focus of standardization tends to be on reduction of transaction costs, enhancing competition by defining what is required to serve a market (information); constituting markets by defining the relevant aspects of products (Tirole, 1988); facilitating scale-economies for suppliers, or influencing the distribution of cost and benefits of building and operating large complex technical systems. (Mansell, 1995). The IP regime and standardization are at a variance and are contradictory at this stage in time (Iversen, 2000).

Due of the nature of competition in markets characterized by IP, there is a drift towards single-firm dominance and sometimes monopolies. Due to the need to encourage initial investments, the law provides IP protection, which precludes competition within the scope of the IP for a period of time (Strange, 1996). Products and services based on IP are characterized by large initial investments (fixed costs) and low costs to reproduce (variable costs). Due to the low cost of producing additional items, innovators find it to their advantage to add purchasers and users; hence price in the short-run often declines in an effort by the innovator to increase sales. It logically follows that the competition to be the first to generate products and services covered by IP protection is therefore beneficial for consumers and should be encouraged and preserved (Mansell, 1995).

The success of competition is frequently based on qualitative rather than quantitative factors. The one who can be the first to design, protect with IPs, and bring to market a new and improved product or service has an advantage (Strange, 1996). This presents a conundrum to balancing IP protection and

ensuring a competition policy than ensures products and services are affordable and that there are no single firm dominances or monopolies. The issue of protection without over protection is still an unresolved issue (Strange, 1996). This creates a conundrum for local innovators, who lack the knowledge and capacity to understand these complex IP issues.

2.16 IP political challenges

The political economy of IP and technology policy has continued to evolve with time. IP policy in the 1990's and early 2000's tended to be siloed - issues were more distinct from one another. The world has continued to become complicated is the range of issues that people interested in innovations and technology have to confront and the ways in which they interact with one another (Mansell, 1995).

IP-induced inequality in all its forms is a global problem. There are accelerating patterns of socio-economic inequality in the global political economy. High prices of products and services have led to socio-economic inequality. Such social inequality is arising at the intersections of three dimensions of asymmetry—asymmetries of market power, social power and political power—which underpin and crystallize around IP enabled global value chains. Such global value chains underpin the global economy—one organized around IP enabled global value chains and global production networks. Such networks are driven by patents, which bring social inequality leading to agitated populations (Keohane and Nye, 1970; Gilpin, 1975). The issue of labour and labour exploitation in global value chains brings about the big question of power and inequality. Low salaries and high costs of products, creates poverty, leads to high crime and unstable communities and nations.

In terms of international and diplomatic relations, big businesses have attracted more attention than ever before (Keohane and Nye, 1970; Gilpin, 1975). With economic globalization, international relations are more and more underpinned by cross-border businesses that mostly produce IP protected public goods and services. Globalization transfers the locus of global governance from nation-states, to private actors such as nongovernmental organizations (NGOs) and multinational firms (Strange, 1996; Kahler and Lake, 2003). Thus businesses that own IP can exacerbate economic confusion in international relations through the precipitation of trade conflict and financial crisis.

Such businesses can also cause political and social problems by seeking low production costs to maximize profits, which can have adverse effects such as environmental pollution and degradation; violation of human rights through poor working conditions; political corruption through bribery of governments; and occupational risks to safety and health for their employees (Reichman, 2009). Lack of

appropriate IP laws and government policy may put local innovator at a disadvantage against international companies.

2.17 IP socio-economic challenges

There is a growing debate on the importance of having a free culture. Technological changes and changes in IP laws have brought intense focus on this issue with the concern that the ability to build on the work of others that is IP protected is being curtailed. Another issue is the mechanisms used to protect IP, which is eroding fair use rights. When it comes to ICT and digital media, the line becomes even more blurred. The primary assets of technology companies are no longer factories and machines; increasingly, the value in a company is in the innovative ideas and concepts underpinning the products and services traded by the company. This asset class requires better management to ensure no loss is accrued from the management of such assets.

In addition, the globalization of laws on IP through trade agreements and adoption of WIPO guidelines by countries has impeded local business from entering the market due to competing foreign products and services, which creates undue advantage to foreign companies over local companies resulting in slower growth of local companies and loss of job opportunities.

According to Reichman (2009), the challenges and controversies around IP include, IP preventing new innovations from being built based on patented innovation. In terms of access to health care, IP helps encourage pharmaceutical companies patent medication, which puts it out of reach by those who cannot afford it. IP rights are also viewed as being too broad in nature and not very well defined and since IP has to do with ideas, it is by nature vague. Some critics argue that IP no longer functions to protect the IP rights of innovators, but rather the economic interests of a privileged few (Drexl, 2005; Reichman, 2009).

There is also the issue of abusive licensing practices and patent-related cartels, which arise due to lack of administrative and enforcement capacity by government agencies. A cartel achieves returns by restricting output and setting high prices like a dominant IP holder. Cartels and other forms of monopoly power are considered from their legal aspects (internal organization and relations to clients and governmental authorities) or from the point of view of their economic aspects (effect on prices, salaries, production, and distribution of services and products) (Bird, 2009).

The concept of patent pools has also been the subject of discussion in legal, social and economic perspectives. On the one hand, patent pools may have positive effects on competition and innovation. The sharing of IP assets, may lead to the development of new products and reduce their transaction costs. On the other hand, under specific circumstances, patent pools may provide an opportunity for anti-

competitive behavior: like any cooperation among competitors, they involve an inherent risk of collusive behavior and a patent pool may in this respect be regarded as a cartel. In addition, there may be competition-related concerns regarding the licensing practices and restrictions that such licensing brings forth which may lead to lack of access to critical products and services (Stiglitz 2006; Crager and Price 2009. This is more so with entry of international companies, who end up taking control of locally developed IP.

2.18 IP moral-ethical challenges

IPRs as a socio-economic tool creates a temporary monopoly for innovators and enables them to charge prices for their innovations that are many times higher than the marginal cost of production of the innovations. This allows the firms to salvage their research-costs and secure a profit on their innovations. There is however a school of thought that posits that IPRs give rise to a number of ethical problems. The ethical problems raised by IPRs are most pertinent when it is socially valuable goods and services that are involved (Stiglitz, 2006; Crager and Price, 2009).

According to Pogge (2005), IPRs allows the innovator firms to salvage their research-costs and secure a profit on their innovations. So, in virtue of increasing the financial attractiveness of engaging in the process of producing innovations, IPRs can be and often are, instrumental in correcting the market failure of undersupply of innovations. for public goods and services.

IPRs for innovations also create another market failure that consists in the fact that a number of mutually beneficial transactions between the seller and buyer do not take place (Pogge 2005). The relatively high price of an IP protected innovations squeezes certain potential buyers out of the market: namely those buyers who are able and willing to buy the product if it was priced just above its marginal costs of production but cannot afford the product when it is priced at the profit maximizing level that obtains during the period in which the product is IP protected. The feature of IPRs is that they squeeze out certain potential buyers from the market creates in what is labelled the 'exclusion problem' or 'access problem' (Selgelid 2008). The exclusion and access problem is morally troubling when it is life-saving technology and not merely computer software that some people are excluded from having access to (Pogge 2005).

The exclusion and access problem is not the only thing that follows in the wake of strong IPRs. A different problem is the 'availability problem' (Selgelid 2008, Love and Hubbard, 2007). This problem is introduced in the context of R&D of products used by low-income households. The R&D of such

products mainly affects people in low-income countries because many poor people simply do not have sufficient money to pay for highly priced products and services.

The availability problem is a consequence of the fact that the incentivizing mechanism for innovation constituted by IPRs establishes a direct link between the incentive to innovate and the price of the innovative product. Under an IPR regime, profits are generated exclusively from sales (Kremer and Glennerster 2004; Barder , 2005). This means that the higher a price a product can command on the market, the higher is the incentive to invest resources into the R&D process of it. An IPR driven regime is therefore not a regime that is conducive to the investment in R&D of products that are socially valuable to predominantly poor populations or populations that are small. Socially valuable goods to such populations are simply not being made available at the same rate as goods that are socially valuable to relative rich populations of a significant size (Bird, 2009).

The problem of the protection of IPR and public health is a key issue. The Agreement of Trade-Related Aspects of Intellectual Property Rights (TRIPS) by WTO working together with WIPO highlights the essential role of pharmaceutical products in public health in developing countries. The agreement is about about patent protection weighed against access to essential and necessary medicines. TRIPS has set international minimum standards on domestic legislation for pharmaceutical patents in WTO member countries and enforced domestic implementation to ensure access to medicines (Kremer and Glennerster 2004; Barder et al. 2005). Closer home, access to banking services has been made easier through innovations around mobile banking software.

With regard to ICT innovations, the gaps on IP knowledge, foreign direct investments from international ICT companies and government involvement granted the potential for IP in terms of government revenues and job creation all of which have been identified in this Literature review, are the reasons why I have conducted this study. The results of the study are intended to fill the gaps around knowledge, partnerships and government support to innovators so that they can thrive and create big businesses. I have anchored the three research objectives on these three factors – IP knowledge, international ICT companies and government role.

3 Research methodology, approach and design

3.1 Research rationale and significance

The pace of ICT innovations in Kenya has continued to grow phenomenally with Kenya being recognized globally as a regional ICT hub. There are however IP challenges that the innovators have continued to grapple with and this research focuses on IPs and their influence on the innovations. The study aimed at identifying the IP issues with innovators and provide possible recommendations to government, innovators, international ICT companies who work in Kenya in collaboration with the investors and other players in the ICT sector.

Within the Kenyan context, Intellectual property rights (IPRs) especially in the knowledge and information economy are have hitherto not been well development but from 2000 they are increasingly being used for intellectual capital (IC) leverage. 2010 is the year that mobile phones were introduced to Kenya. The granting of IPRs is the responsibility of the Kenya Industrial Property (KIPI) under the Industrial Property Act (2001). Innovators can also obtain patents through the African Regional Intellectual Property Organization (ARIPO), which is mandated by the member countries, Kenya being one of them to grant patents in consultations with KIPI.

I have looked at the causal conditions that affect the innovators, from little knowledge of patents and copyrights, to weak enforcement of IP laws. The potential and real loss of IPRs and subsequent loss of government revenues and means of livelihood have led me to conclude that this research is significant both for academic purposes and for providing potential solutions to these challenges. Such solutions would have a direct impact on the Kenyan economy given the significance of ICTs in Kenya's GDP growth.

The capability to innovate and to bring such innovations successfully to market is and will continue to be increasingly a crucial determinant of global competitiveness of nations over the coming decades. There is growing awareness among policymakers in governments that innovative activity is and will become the main driver of economic progress and well-being as well as a potential factor in meeting global challenges in many domains such as health, education, agriculture, water and sanitation among other domains. Innovation has not only moved to the center-stage in economic policy making, but there is a critical realization that a coordinated, coherent, whole-of-government approach is necessary and will be required to ensure nations succeed in tapping their innovation potential for national growth and global competitiveness (Baldwin and von Hippel, 2011).

In addition to the rapid and great progress in scientific discovery and in general-purpose technologies such as ICTs and biotechnology, the increasing pace of innovation is driven more by globalization.

Government policies can and need to support innovation by reforming the regulatory and institutional frameworks within which innovations activity take place. The public policy and regulatory framework need to be more conducive to innovation in a range of policy areas from the general business environment.

Governments have a very important role of fostering innovation (Arundel and Kabla, 1998). Public investments in science, research and technology can play a vital role in developing ICTs and hence, in enable further innovation. This highlights the importance of reforming the management and funding of public investment in technology and science to innovative activity in the private sector. The latter calls for an appropriate mix of direct and indirect instruments such as tax credits, direct support and well-designed public- private partnerships, support for innovative clusters and rigorous evaluation of such public support.

The current system of IP laws, practices and rules in Kenya appear not to have done enough to stimulate high-level innovation while allowing access to knowledge according to the study participants. Strong patenting systems and enforcements of relevant laws in the event of breaches are necessary to combat piracy, counterfeiting or outright theft, which are serious and growing problems (Chabchoub and Niosi, 2005).

Today, innovative performance is a crucial factor in determining competitiveness and national progress. Innovation is important to help address global challenges, such as climate change and sustainable development. But it is the application of advances in technology, in conjunction with entrepreneurship and innovative approaches to the creation and delivery of goods and services, which translates technological and scientific advances into more productive economic activity. This results in economic growth if market structures and the regulatory environment enable the more productive activities to expand. This said, the innovative effort itself, including formal research and development, remains the *sine qua non* of growth (Brouwer and Kleinknecht, 1999).

Evidence by the OECD in its 2007 report on innovation and growth, suggests that innovative effort is on the rise as a share of economic activity. Investment in knowledge has grown more rapidly than investment in machinery and equipment since the mid-1990s. Intellectual assets taken as a whole in terms of aggregate measures of human capital, research and development and capacity to conduct it, patent

valuations as well as intangible assets such as brand value or firm-specific knowledge — are rapidly becoming the key to value creation through a number of channels.

The importance of innovation has been spurred and reinforced both by globalization and by rapid advances in new technologies, notably ICTs, which have enabled new forms of competition and opened new markets for the creation and delivery of innovative products and services. Globalization has also increased the pressure on countries to move up the value chain and engage in a continuous process of adjustment and innovation. As a result, major emerging market economies are no longer simply low value- added producers but are adding their weight to the creation and commercialization of innovative products, processes and services (Granstrand, 2003). The innovators work in small and mid-sized firms, which in the Kenyan context have annual revenue range of USD 500,000 to USD 5m. Such firms are a mix of locally owned firms, subsidiaries of foreign firms, as well as firms that have received funding from foreign VCs, PEs and angel investors in the range of USD 100,000 to USD 500,000.

The respondents have had knowledge and experience of the ICT innovations ecosystem in Kenya. This research is therefore grounded on data and information from the participants. Strauss & Corbin (1998) argue that as an inquirer, I need to look at ICT innovators and confirm the challenges they are facing through fact finding and then generate the reasons why the innovations protection environment has not been fully supportive to them.

As Kenya works towards repositioning the economy to be driven by innovation and exponential growth of the service sector through Vision 2030, there are some issues that require a critical analysis as argued out by Goh (2005). How to frame investment opportunities such an innovation-driven economy and determination and documentation of the emerging opportunities. The new investment models necessary as well as acceptable and viable commercial strategies to underpin the innovation investments and identification of the resources and structures within government to drive this national agenda. The operational, tactical and strategic needs that emerging an growing economies require as nuanced intellectual capital investments and the nature of the **RoI2** (returns on innovation investment) and **RoRi** (returns on research investment) and the politically acceptable returns in a growing economy (Lai, 1998).

The public sector institutions in Kenya that are tasked with the protection and promotion of innovations as well as fighting against counterfeits tend to work at cross-purposes and turf wars among them are not uncommon. They appear to lack the drive that is crucial for entrepreneurship protection as well as appropriate flexibility to operate in commercial environments where value is gained or lost based on time taken to execute and implement decisions. In this environment, innovation systems are kept in a ‘low

equilibrium trap' with low levels of R&D and mis-allocation of R&D resources. Instances of vested interests sometimes in government and the need to maintain the status quo hinders innovations, as is the fear to get to uncharted waters for some government agencies whose mandate is to promote and protect innovations.

As the policy, legal and economic environment are still evolving, the situation in the field of IP for ICT innovations is still evolving and strong IP laws and policy need to evolve in tandem.

Kenya is the largest economy in East Africa and the seventh largest in Africa with a GDP of USD 60 Billion (http://www.tradingeconomics.com/kenya/gdp). Kenya has also developed a 25-year development blueprint called 'Vision 2030' (http://www.vision2030.go.ke), in which the contribution to GDP by ICTs is given prominence. The government envisages that by 2030, ICTs will contribute 10-12% to GDP growth. It is therefore clear that the government sees ICT induced growth as key to the growth of the Kenyan economy.

With a population of 47 million as per 2016 Kenyan National Bureau of Statistics figures, Kenya has 70% of the population being youth, below the age of 30. The youth have the flair and attitude to understand and use the latest technologies and the government recognizes the power and resource of the youth as per its STI policy.

To my knowledge and belief such research has hitherto not been a subject of previous research in Kenya. The research process has therefore been exploratory in nature – moving from the known to the unknown. An exploratory study is undertaken where the researcher has some basic knowledge of a subject and seeks to know much more about the situation that obtains in the field of research. (Sekaran,1992).

3.2 Research method

3.2.1 Objectives

The research objectives for this research revolved around innovators, IP, IPRs, roles of international companies and government in fostering innovation and protection of the innovations through IP. The objectives or questions are outlines below:

a) determining the innovators understanding and challenges of IP, IPRs and IC
b) exploring the role and support of international ICT companies in Kenya's ICT innovations with focus on IPs

c) exploring government's role in promoting ICT innovations and protecting the innovators through enforcement of IP laws

3.2.2 Design

The independent variables included ICT innovators and innovations in Kenya, International ICT companies who work with Kenyan ICT innovators and Kenyan government support for ICT innovators. The dependent variables are Intellectual property rights and their influence on ICT innovations in Kenya and the demographics – age, work experience, gender were the control variables.

The nature of this research involved seeking questionnaire responses from ICT practitioners in a select population of respondents. The research seeks responses and views from participants, relating to the conduct of innovation and the environment around innovation in Kenya. Due to the specialized knowledge expected of the respondents, it was imperative that I identify the respondents, who would provide the necessary responses based on knowledge and experience in ICT. I therefore defined the target population using purposive sampling, which is also known as selective, subjective or judgment sampling. A researcher adopts purposive sampling where the population has certain characteristics and knowledge of the research subject. Such a limited number of respondents align with the research objectives. In addition purposive sampling is a non-probability sampling method. The sample selected for the research is selected by the researcher's judgment, which often saves time and money. In this research my purposive sampling focused on ICT innovators within innovator and accelerator hubs and people with knowledge of ICT and innovation from government, IP lawyers and industry practitioners with over ten years of experience. The sample size for purposive sampling

I utilized homogenous sampling which is applicable for pilot studies, case studies, qualitative research, and for hypothesis testing. The number of ICT innovators is not known and it continues to grow with many ICT graduates continuing to join the 'world of work'. I further separated the sampled population in to two categories – one group made up of innovators for which I developed a Likert scale three part quantitative questionnaire (See Appendix 1), each part focusing on each of the objectives of this research. Using the sampling guideline of above fifteen and under fifty respondents, I visited and made presentations to innovators in several hubs mapped in the map below. I presented on the nature of my research and the reason for requesting them to participate. I received positive responses from sixty four innovators who expressed interest in participating. The process of getting research consent forms from hem took over five months and by then about fourteen innovators had changed their mind about participating in the research. Of the remaining fifty, I sent out fifty questionnaires, thirty of them in hard

copy and twenty of them on email to the innovators to fill in. I received back 37 completed questionnaires, which were within the sample population guideline above Palys (2008).

The hubs I visited are located in close proximity to universities and high-speed internet installations. The city of Nairobi contributes more that 70% of the country's GDP and I therefore considered it suitable to conduct the research within the city.

Figure 2 - Map of innovation clusters

The second category was made up of government ICT officials, IP lawyers and other experienced ICT practitioners for which, I prepared a qualitative questionnaire (see Appendix 1) with seven themed questions three questions for government officials to respond on government role in IP and four questions on IP issues for IP lawyers and ICT practitioners. My sample population for this category was twenty. I conducted face-to- face interviews with seven respondents to gain deeper insights, which I would otherwise not have gotten from a quantitative questionnaire. The sixteen respondents were the Permanent Secretary for ICT, the CEO ICT Authority, Director Kenya Copyright Board, Director Vision 2030 Secretariat, three IP lawyers, four representatives of ICT lobby organizations and five experienced ICT practitioners. I scheduled and had interviews with them in their offices, which they considered appropriate in the event they need to reference some relevant materials.

Using the guideline that qualitative research sample population should be above 15 and under 50, I consider the population of sixteen as adequate. At this point, it is worth noting that due to my background and experience in the ICT innovation activity, I categorized as a 'passionate participant' within the ICT and innovation world that I was researching (Guba and Lincoln (1994).

In addition, I utilized ICT industry forums, business associations and e-discussion forums for more information on the state of innovations in Kenya. E-forums such as KICTANet offered insights in the ICT industry in terms of policy, regulation business opportunities and growth plans. I also conducted desk and internet research on relevant entities and their role in IP and innovation. These were the National Council for Science and Technology and the Kenyan Industrial Research and Development Institute

3.2.3 Mixed methods

Tashakkori and Teddlie (2003) note that there are three areas where a mixed methods is superior to a single methods approach. First is the ability to answer research questions that other approaches cannot; mixed methods can answer simultaneously, confirmatory and exploratory questions and also provide stronger inferences through depth and breadth in answer to complex social phenomena. They also provide the opportunity for expression of differing view points through divergent findings (Creswell 2003). Since I was interviewing different categories of respondents, mixed methods therefore best suited this research.
Bryman (2004) puts forward a number of arguments for mixed methods research. These include; the logic of triangulation, an ability to fill in the gaps left when using one dominant approach, the use of quantitative research to facilitate qualitative research and visa versa, combining static and processual features, gaining the perspective of the researcher and the researched, to address the issue of generality and to study different aspects of a phenomena (Tashakkori and Teddlie, 2003).

According to Johnson and Onwuegbuzie (2004), a mixed method research approach if applied pragmatically assists a researcher gain a deeper understanding of the research phenomenon. The results from each method 'speak' to the researcher and therefore 'bridge the gap or the divide' for a researcher who doubles up as a scholar practitioner in business and management research. The mixed methods also assists a researcher to bring together the proponents of either (quantitative or qualitative) research method.

According to (Creswell 2003; Hanson, 2005; Patton 2002), mixed methods research is 'a paradigm whose time has come' taking advantage of the strengths of both methods (Johnson and Onwuegbuzie 2004). I relied on the work of Creswell (2003) who listed four questions that require a clear and succinct resolution in order to develop a mixed methods research strategy that is robust, relevant and can stand the

rigour and relevance. What is the implementation sequence of the quantitative and qualitative data collection in the proposed study? What priority will be given to the quantitative and qualitative data collection and analysis? At what stage in the research project will the quantitative and qualitative data and findings be integrated? and will an overall theoretical perspective of gender, race/ethnicity, lifestyle, class be used in the study?

Further, there are many different mixed methods topologies suggested and available for use by researchers who adopt mixed methods in their research (Teddlie and Tashakkori, 2009; Creswell and Plano Clark, 2007; Johnson and Onwuegbuzie, 2004). Based on the listed questions above (Creswell, 2003) and the mixed design matrix (Johnson and Onwuegbuzie, 2004) below, I have adopted the QUAN + qual topology. This means that in terms of time order, the methods were done concurrently, and in terms paradigm emphasis, the quantitative had the dominant status.

Paradigm Emphasis Decision	Time Order Decision: Concurrent	Time Order Decision: Sequential
Equal Status	QUAL + QUAN	QUAL → QUAN QUAN → QUAL
Dominant Status	QUAL + quan QUAN + qual	QUAL → quan qual → QUAN QUAN → qual quan → QUAL

Adopted from Johnson and Onwuegbuzie (2004 pp.99)

Figure 3 - Mixed methods research topologies

3.3 Data collection challenges

Immediately after completing my DBA modules and in the process of identifying and selecting a suitable thesis supervisor, I took long before I identify the supervisor, who has support me. I had two supervisors I had identified indicated their work-load would not afford them time to be my supervisors. When I eventually identified an appropriate supervisor, he had to pull out after three months due to ill health. It took a while a while to identify my current supervisor. This process took four months of my thesis time.

Before the process of data collection, and to ensure foolproof questionnaires, I carried out a pilot test on volunteer respondents in order to test the veracity and in-depth coverage of the questionnaire. The pilot

led to further improvements before the questionnaire was administered on the sampled population. I piloted the qualitative questionnaire with the Permanent Secretary for ICT to determine its utility. I made further improvements before I carried out formal interviews with other selected participants. Before administering the quantitative questionnaires, I made formal presentations to groups of innovators for them to understand the questionnaires.

In quantitative research, I faced the challenges of respondents dropping out of the research during the process of getting them to sign the research consents. This took over five months and the respondents reduced to 37 from a population of 60, to who I had made presentations on this research. The qualitative research respondent also took long to confirm appointments and it took me over six months to interview all the responds. Cumulatively the process of data collection alone took me about 14 months to complete. In retrospect, I would have planned data gathering much better, first by ensuring that when I made the presentation to the innovators, I carried the consent forms with me to shorted the process and for the qualitative respondents to seek a focus group discussion approach especially for ICT practitioners and ICT lobby organizations to shorten the time for data collection.

During data analysis and reporting, I faced immense challenges. I had to re-learn the use of SPSS statistical analysis software. This took a long time since I wanted to ensure I have the skills to use the software to ensure I do the right analysis. I have several iterations to improve on the analysis.

My preparation for the viva voce and the feedback from examiners also presented challenges due to the amount of thesis re-work. I have had to put in long hours outside my work environment and family time to address all comments to the satisfaction of the examiners.

3.4 Research paradigms

I consider that a critical step in undertaking this research is the selection of an appropriate paradigm within which to underpin the research. A paradigm, or ‘a view of the world’, is a conceptual framework comprising a basic set of beliefs or assumptions that act as a guide to the researcher (Creswell 1994; Healy & Perry 2000), providing a clear distillation of the researcher thinking regarding the world, but which thinking the researcher is not able to prove unless with the help of the research process to its conclusion (Lincoln and Guba, 1985).

During my coursework on management research, I learnt that (Guba and Lincoln (1994) and Perry, Reige and Brown (1999) did extensive study and averred that scientific research is conducted within four key

paradigms – positivism, critical theory, constructivism and realism (Perry, Reige and Brown, 1999), or postpositivism (Guba & Lincoln, 1994)

Easterby, Thorpe and Lowe (1991) have provided an illustration that shows the variations in approach to terminology in the literature provided. They have gone further and combined constructivism and the critical theory paradigms into one paradigm, which they have referred to as the phenomenological paradigm. It is also referred to as the qualitative or interpretive paradigm (Perry and Cavaye, 2002). I have summarized my understanding of the research paradigms in the table on the next page.

Table 2 - Research paradigms

Paradigm	**Ontology**	**Methodology**
'World view'	What is the form and nature of reality and, therefore, what is there that can be known about it?	How can the inquirer go about finding out whatever he or she believes can be known?
Positivism	Naïve realism: Reality is real and apprehensible	Experimental/ manipulative: Verification of hypotheses: chiefly quantitative methods
Critical Theory	Historical realism: 'Virtual' reality shaped by social, economic, ethnic, political, cultural, and gender values, crystalized over time	Dialogic/dialectical: Researcher is a 'transformative intellectual' who changes the social world within which participants live
Constructivism	Critical relativism: Multiple local and specific 'constructed' realities of innovators, government	Hermeneutical/ dialectical: Researcher is a 'passionate participant' within the world being investigated
Realism Realism (Perry, Reige & Brown) or Pragmatism, Postpositivism (Guba & Lincoln)	Critical realism: Reality is 'real' but only imperfectly and probabilistically apprehensible and so triangulation from many sources is required to try to know it	Case studies /convergent interviewing: Triangulation, interpretation of research issues by qualitative and quantitative methods such as structural equation modeling. Modified experimental/ manipulative; critical multiplism; falsification of hypotheses

Adopted from Perry, Reige and Brown (1999, pp.17) and Guba and Lincoln (1994, pp.109 and 112).

The pragmatic paradigm has what (Tashakkori and Teddlie. 1998) and (Creswell, 2003) see as intuitive appeal, permission to study areas that are of interest, embracing methods that are appropriate and using findings in a positive manner in harmony with the value system held by the researcher (Creswell, 2003). Pragmatism can be defined as dealing with things sensibly and realistically in a way that is based on practical rather than theoretical considerations. It can further be argued that the pragmatic paradigm can be adopted for the purpose of social and management research endeavours as this is congruent with the mixed quantitative and qualitative approach taken within the predisposition of 'practitioner-based' research. The mixed methods approach associated with the pragmatic paradigm and strategies involves collecting data in a simultaneous or sequential manner using methods that are drawn from both quantitative and qualitative traditions in a fashion that best addresses the research questions' (Creswell, 2003).

3.5 Data validity

Data validity is an indication of how sound my research is and it applies to both the design and the methods of the research. Validity in data collection means that my findings truly represent the phenomenon I am claiming to measure. Valid claims are solid claims. The purpose of establishing validity in research is essentially to ensure that data are sound and replicable, and the results are accurate

The quantitative data collection tools that I have used in this research are based on the Likert scale, which is widely used in research (Lavkaras, 2008) not necessarily related to ICT innovators and innovations but nevertheless relevant for my research. I consider validity, in this research, to refer to whether the findings of a study are certain and true—'certain' in the sense that the research findings are and can be supported by the evidence and 'true' in the sense that research findings accurately reflect the situation. I have adhered to best practice to assure of this data validity. Data validity is the degree to which a survey instrument measures what it is supposed to measure or the degree to which results obtained from the analysis of the data provide a representation of the phenomena under study (Field, 2004).

There are three methods for testing data validity.

Criterion validity method requires demonstration of a correlation or other statistical relationship between research data and real industry data. Content validity method requires a demonstration that the data is relevant to and measure directly important aspects of the phenomenon being studied. Construct validity method requires a researcher to demonstrate that the real environment that the data claims to measure is true (French, 1990). This method often pertains to tests that may measure abstract traits of an applicant.

(French, 1990, p. 260).

Further, the construct validity use two main validity, convergent validity and discriminant validity, to confirm the validity of the data. Convergent validity tests that constructs that, are expected to be related, are in fact, related.

I have used the construct validity method to test whether the variables used in this research define well the Intellectual property rights and their influence on ICT innovations in Kenya. Pearson Correlation has been utilized, where some variables (1-11 in the table below have been randomly selected from each of the three objectives, then a summation of responses have been calculated which represents the subject matter being investigated. To prove validity, if all the variables chosen show significance then the tool is valid. A new variable at total was computed to represent level of Intellectual property rights and their influence on ICT innovations in Kenya.

The method used, shows that the variable shows significance at levels of 0.01 and 0.05, a demonstration of data validity.

Table 3 - Data validity measurement

	Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11
1.	Understand the concepts of Intellectual capital (IC) and property rights (IPRs)			1										
2.	They know and understand how to value their innovations			.997**	1									
3.	They understand the existing laws and regulations to protect and nurture their innovations			0.208	0.241	1								
4.	They have developed business plans and guide their business growth plans			.575**	.632**	.509**	1							
5.	They relentlessly pursue grants opportunities with government and other international agencies to improve their innovations			.424**	.421**	0.074	0.224	1						
6.	They have developed Standards Operating Procedures (SOPs) for their businesses			-0.117	-0.117	-0.143	-0.071	.512**	1					
7.	They have Research and Development sections/divisions/department to manage innovations growth			0.081	0.1	0.033	0.255	.559**	.751**	1				
8.	The judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations			-0.021	-0.005	-0.075	0.172	.657**	.571**	.608**	1			
9.	The Government provides tax incentives			-0.137	-0.137	0.09	-0.083	.591**	.853**	.626**	.460**	1		
10.	The Government provides business opportunities within its ministries and agencies			0.027	0.045	-0.033	0.219	.326*	.544**	.766**	.391*	.433**	1	
11.	The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for us			.603**	.611**	0.054	.460**	.794**	.381*	.608**	.750**	0.279	.395*	1

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)
Correlations and Descriptive Statistics (n = 50)

3.6 Data reliability

Data reliability is a state that exists when data is sufficiently complete and error free to be convincing as to its purpose and context. Reliability refers to the consistency and is very important in research because it tests if the research fulfills its predicted aims and hypothesis and also ensures that the results are due to the study and not any possible extraneous variables.

In this research, I have ensured the reliability of the study instruments by using Cronbach's alpha (Cronbach, 1951) to measure internal consistency. Cronbach's coefficient alpha determines the internal consistency or the average correlation of items within the test. This is widely accepted instrument in testing the validity of data. In this research, I used it after collection of data to test the results. Alpha measures the internal consistency to determine if certain items of the survey tool were within the scale measure and same contrast. It establishes if the measure will yield the same results on other occasions or similar observations are arrived at by other observers (Hatcher, 1994) as well as transparency in the raw data.

The reliability of a test is indicated by the **reliability coefficient or Cronbach's alpha value** and it is denoted by letter 'r'. It is expressed as a number ranging between 0 and 1.00, with r = 0 indicating no reliability, and r = 1.00 indicating perfect reliability. Generally, data reliability is a decimal, for example, r = .80 or r = .93. The larger the reliability coefficient, the more repeatable or reliable the test scores. Table 1 provides a a general guideline for interpreting data reliability. To evaluate data reliability, it is important to the type of data, the type of reliability estimate reported, and the context in which the test will be used.

Table 4 – Data reliability coefficient ranges

Reliability coefficient or Cronbach's Alpha value	**Interpretation**
.90 and up	excellent
.70 - .89	good
.50 - .9	adequate
below .50	may have limited applicability

Sekaran (2003)

As indicated above, the data reliability to check the internal consistency of the data-measuring instrument also know as the Alpha value ranges from 0, which denotes no internal consistency to 1.00, which denotes complete internal consistency. The higher the coefficient, the more reliable the measurements scale. Kilin

(2003) established that Alpha value threshold is at 0.6. Nunnally (1978) proposed that if values were too low, either few items were used or the items had little in common and suggested that a value of 0.70 and above was sufficient. However, (Nunnally, 1978) argued that an alpha coefficient of 0.70 is adequate to accept presence of internal consistency. For the purposes of this study, the alpha coefficient for the sample was put at 0.70 (Nunnally, 1978).

According to (Nunnally, 1978), an alpha coefficient of 0.7 is sufficient, however some (e.g. Sekaran, 2003) based this on arguments of an alpha coefficient of between 0.5 and 0.8 as sufficient, the Alpha value. In this study, all the total the total of 38 variables were initially examined which yielded 0.571. To achieve the acceptable alpha of 0.7, I examined 38, 37, and finally 36 variables as shown in the table below.

The details are in Appendix 5, and below is an extract showing that when three variables are deleted, Cronbach Alpha becomes 0.734, which demonstrates that the data for this research is reliable. The table below shows how the deletion of variables resulted in an acceptable Cronbach Alpha of 0.734 for 35 variables.

Table 5 - Data reliability table

Cronbach's Alpha	No of variables
0.734	35
0.690	36
0.620	37
0.571	38

3.7 Ontological, epistemological and methodological implications for pragmatic mixed methods research

The research that is underpinned by pragmatic research paradigm is that of mixing data collection methods and data analysis processes and procedures within the research process (Creswell, 2003). Tashakkori and Teddlie (1998) propose that there are three approaches to research, quantitative, qualitative and mixed methods.

The quantitative approach is associated with the post-positivistic paradigm, which employs strategies of inquiry like experimental surveys and the methods of data collection are pre-determined and result in numeric data. The qualitative approach is associated with constructivist paradigms and is applicable in

case studies. It uses methods or data collection such as the interview resulting in open-ended data textual data. Thirdly is the mixed methods approach associated with the pragmatic paradigm and strategies that involve collecting data in a simultaneous or sequential manner using methods that are drawn from both quantitative and qualitative traditions in a way that addresses the research question (Creswell 2003).

In this research, I have identified a number of issues that drive the research design approach. These include the paradigm stance, plan and method, (2003) which are also influenced by the match between the research problem and the research approach, the experience of the researcher and the audience (Creswell 2003).

According to (Tashakkori and Teddlie, 1998), there are limitations of adopting single research methods and this stance has been strengthened by the general acceptance of the compatibility thesis (Holmes, 1992) whose rise and accepted limitations of, has strengthened the position of the advocates of mixed methods approach to research. In a mixed methods design, as adopted in many social and management research studies, the data collection methods or procedures and analysis techniques used are from both the qualitative and quantitative traditions, the collection and analysis proceeds in either a parallel [QUAL+QUAN] and [QUAN+QUAL] or sequential manner [QUAL/QUAN] and [QUAN/QUAL]. (Tashakkori and Teddlie 2003).

Tashakkori and Teddlie (2003) note that there are three areas where a mixed methods approach is superior to single-methods approach. Mixed methods can answer simultaneously confirmatory and exploratory questions and they provide stronger inferences through depth and breadth in answer to complex social phenomena. Mixed methods also provide the opportunity through divergent findings for an expression of differing viewpoints.

The position by (Bryman, 2004) is what he terms NOT mixed methods but the combining of quantitative and qualitative research, which covers the logic of triangulation, ability to fill in the gaps left when one method is dominant, use of quantitative research to facilitate qualitative research and visa versa, combining static and processual features, gaining the perspective of the researcher and the researched, to address the issue of generality and to study different aspects of a research phenomena.

From the discussion around paradigms, it can be proposed and deduced that adopting a paradigm implies taking a particular approach to research. The pragmatic paradigm used in this research implies that the approach to research is that of mixing data collection methods and data analysis procedures within the research process (Creswell, 2003). Creswell's approach characterizes a paradigm as a knowledge position, which underpins research design and data collection methods (Creswell 2003).

The word ‘methods’ is applied and used in various ways and in an unregulated fashion and should only be reserved to data collection tools used within the research process. Thus, the questionnaire, focus group, interview, observation all fall into this category. However, the word ‘method’ is also used as a research strategy such as a survey, ethnography and experiment.

‘Method’ represents the ‘third tier of the research hierarchy if we follow the ontological (philosophical rationale for conducting research), the epistemological (the strategic/methodological rationale for conducting research), and methods, the mechanics of doing research which is the data collection phase. The fourth level in the hierarchy is data analysis procedures and techniques which can be viewed as being a separate part in its own right or as integral part of the data collection (methods) phase of the research process depending upon the research strategy adopted by the researcher. Following the preceding argument the word ‘method’ should be reserved for the data collection phase of the research process in order to save confusion within and outside the research fraternity.

Quantitative and qualitative research designs operate at a metaphysical level in terms of their ontological and epistemological assumptions and value systems. As a research, I am of the view that the human mind can ‘see beyond the metaphysical divide’ of these two approaches as well as see simultaneously their separateness. Therefore the word ‘mix’ is not an appropriate term to use in the context of ‘mixed method’ research since one cannot mix together the ontological and epistemological underpinnings of the pragmatist researcher.

The pragmatic nature of management, social and organizational research, means mixed methods research acquires a new definition of ‘mutual research designs’. Mutual infers recognition of the separateness of opposing views, attributes, characteristics and beliefs of others. A partnership based upon a reciprocal relationship. Being mutual recognizes that each can work together whether it is in a sequential, concurrent, and nested or combinations of such research designs as suggested by (Tashakkori and Teddlie, 1998) and Creswell (2003). Mutual research designs solve the contradictory and opposing views of the positivist (quantitative) – interpretivist (qualitative) paradigm debate and is congruent with the pragmatic paradigm and for that matter real life research.

In conclusion, the ontological, epistemological and methodological implications for practitioner-based research environment whose outputs must have rigour, relevance and practical utility leads to research focused on solving and solves real business and social problems.

4 Data analysis and representation

As a researcher, if I regard this as a social situation, then it forms the unit of analysis, which requires me to be reflexive and not necessarily regard myself as the 'all knowing analyst'. I have collected, analyzed and reviewed documents – gathering data in the field, analyzing it, back to the field for more data and clarifications and back to data analysis. The process of data collection involves several passes so as to determine emerging categories in comparative data analysis.

The data was cleaned, coded and analyzed using the IBM SPSS Statistics software version 23. Quantitative data was analyzed using non-parametric statistical inferential methods and presented using three strategies thus exploratory analysis presenting the data graphically, descriptive analysis and inferential statistics to test hypotheses about the data to draw conclusions about the larger population. The Pearson's Chi-square test was used to show associations between independent and dependent variables. The association of the characteristics and the outcome was be compared by use of Kruskal Wallis H Test and equivalent of Analysis of Variance (ANOVA) for parametric tests. Correlation analysis was used to measure strength of relationship between variables. A p value of < 0.05 was considered statistically significant.

Quantitative analysis is meaningful when there is a need for data summary across many repetitions of a participatory process. These may include focus group discussions or questionnaires completed by respondents in similar circumstances or with discernible similar experience and exposure. The summarization of data then implies that some common features do eventually emerge across such repetitions. The value of a quantitative analysis arises when it is possible to identify features that occur frequently across the many research participants for a particular research theme. Quantitative analysis facilitates the reporting of summary results in numerical terms to be given with a specified degree of confidence

4.1 Non-parametric test

The data collected does not lend itself to parametric statistical analysis methods owing to the fact that the data is from an unknown population, was selected conveniently through purposive sampling, and hence did not meet most parametric assumptions such as normality and being skewed (skewness) and being flat peaked (Mesokurtic). The age of organizations and number of staff within the organizations were used to test for normality, skewness and kurtosis within the data. On the basis of the skewness and kurtosis statistics in the table below, the data is only within acceptable levels for non-parametric tests (Anderson, 1961; Siegel and Castellan, 1988; Daniel, 1990). It is worth noting that non-parametric tests are

unaffected by the distribution of the data and they also accommodate many conditions such as small sample sizes, ordered outcomes, and outliers. Data is considered to be normally distributed when skewness statistics value is closer to zero and kurtosis 3. For data that does not fit a normal distribution, the skewness and kurtosis deviate a lot from 1.0, which is the case in the table below, which justifies non-parametric tests for this research (Lavrakas, 2008; Daniel, 1990).

Table 6 - Measurement of data skeweness and kurtosis

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Age of Organization	37	3	10	6.81	1.868	0.237	0.388	-0.564	0.759
Number of staff	37	2	14	7.35	4.198	0.411	0.388	-1.417	0.759

The data having failed to meet parametric assumptions, non-parametric methods were employed and the methods used were descriptive statistics, correlation to measure strength of relationship between variables, Chi Square to test for relationship between variables, Man Whitney test was used to compare two different samples within the data, Kruskal Wallis Test was to compare more than two samples within the data and Factor Analysis was used to test for variability among variables and which were more influential.

Non-parametric statistics tests do not relate to specific parameters (the broad definition) and they do maintain their distributional properties irrespective of the underlying distribution of the data and they are therefore referred to as distribution-free methods.

These statistics compare distributions instead of parameters and therefore do not have less restrictive assumptions even though certain assumptions such as ‘samples are independent and random’ are necessary. For ranked data, which can be put in the order, and/or categorical data, nonparametric statistics are required. They have several advantages, in the sense that they are appropriate when only weak assumptions need to be made about distribution, they can be used for categorical data in cases when no measurement scale that is adequate is available, for ranked data they may be the best option and they are quick and easy to learn and apply since they involve ranks, counts and signs.

Factor analysis was also applied in this research to identify underlying variables, or factors, that explain the pattern of correlations within a set of observed variables. Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of manifest variables. Factor analysis can also be used to generate hypotheses regarding causal mechanisms or to screen variables for subsequent analysis (for example, to identify collinearity prior to performing a linear regression analysis).

Table 7 - Socio-demographic characteristics of respondents

	Characteristics	**Frequency**	**Percentage**
Age	Below 25	16	43.2
	25-34	21	56.8
	Total	**37**	**100**
Gender	Male	23	62.2
	Female	14	37.8
	Total	**37**	**100**
Level of education	High school certificate	2	5.4
	University degree	34	91.9
	Post graduate degree	1	2.7
	Total	**37**	**100**
Citizenship if Kenyan	Yes	33	89.2
	No	4	10.8
	Total	**37**	**100**
Duration working in a particular role	1	2	5.4
	2	3	8.1
	3	15	40.5
	4	16	43.2
	5	1	2.7
	Total	**37**	**100**
Type of business	Entrepreneur	23	62.2
	Innovator	14	37.8
	Total	**37**	**100**
Age of organization	<= 3	1	2.7
	4 - 6	15	40.5
	7 - 9	16	43.2
	10+	5	13.5
	Total	**37**	**100**
Number of staff	<= 3	9	24.3
	4 - 6	10	27
	7 - 9	6	16.2

	10 - 11	6	16.2
	13+	6	16.2
	Total	**37**	**100.0**

From Table 9 above, majority of respondents were of age 25 years and above 56.8%, being males 62.2%, with university degree 91.9%, being Kenyan citizens 89.2% and who entrepreneurs are 62.2%. These factors are important ingredients as far as intellectual property rights and their influence on ICT innovations in Kenya is concerned.

4.2 Quantitative analysis - Objective 1

1. Determine their understanding of IP for protecting their innovations and what the future holds for them.

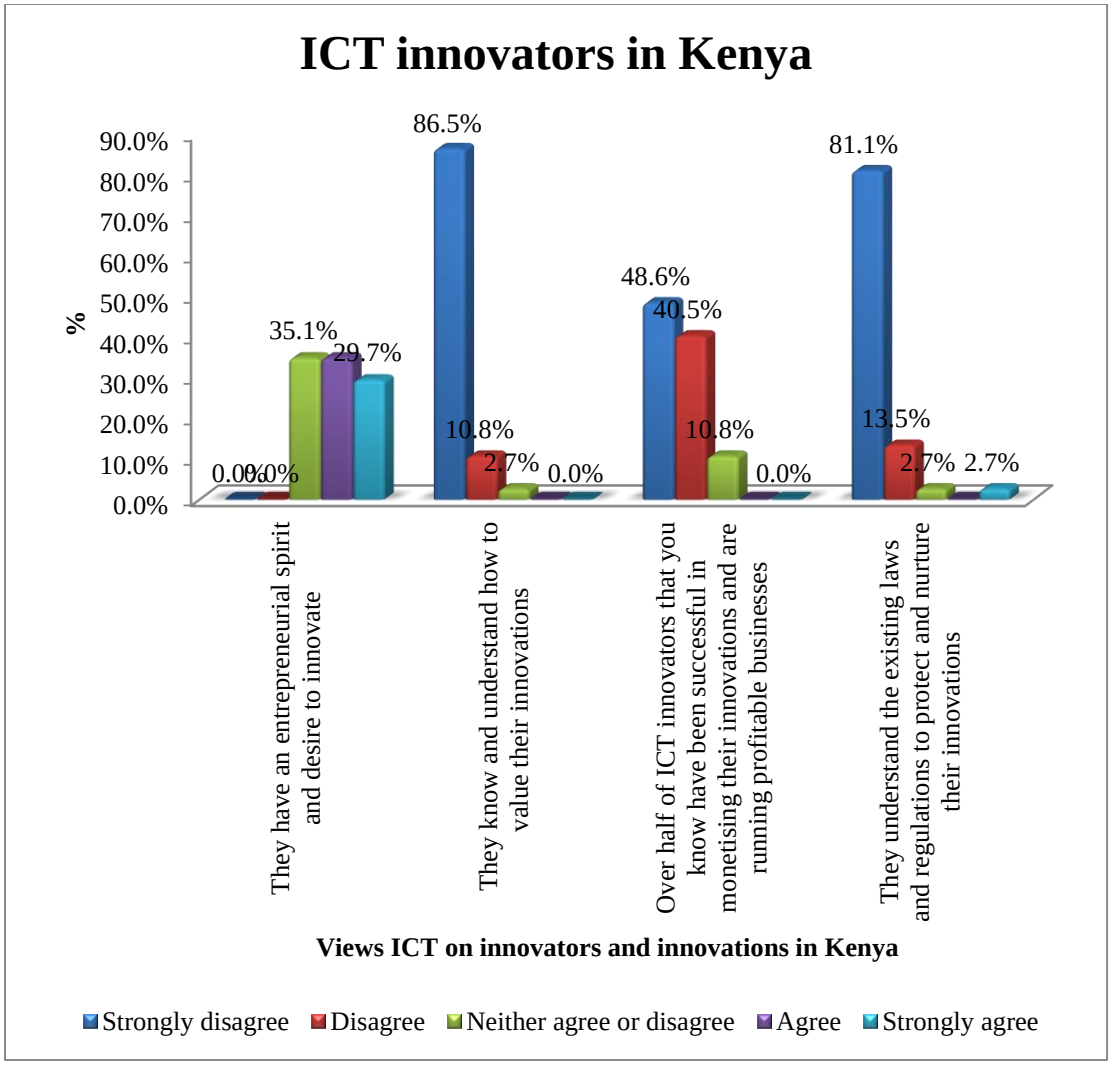

Figure 4 - Views of ICT innovators

From figure 4 above, descriptive statistics was carried out to determine which research factor was viewed favorably. The only factor that showed agreement among the respondents is that they have entrepreneurial spirit and desire to innovate at 64.9%. The rest of the factors showed disagreements by over 80%, understanding how to value their innovations 97.3%, ICT innovators known by the respondents to have been successful in monetizing their innovations and are running profitable businesses at 89.2% and understand the existing laws and regulations to protect and nurture their innovations at 94.6%. From the results, there is a confirmation that innovators in Kenya have entrepreneurial spirit and desire to innovate but have a challenge with the other factors.

To further determine the understanding of these responses, inferential statistical tests were carried out.

a) Strength of relationship analysis.

Non-parametric partial correlation analysis was carried out to test the degree of relationships between factors influencing ICT innovators and innovations in Kenya.

Table 8 - Descriptive statistics and correlation analysis on innovators

ICT innovators and innovations in Kenya	**1**	**2**	**3**	**4**	**Mean**	**SD**	**Mode**
1. They have an entrepreneurial spirit and desire to innovate	1				3.95	0.815	3
2. They know and understand how to value their innovations	0.257	1			1.16	0.442	1
3. Over half of ICT innovators that you know have been successful in monetizing their innovations and are running profitable businesses	**-.488****	-0.252	1		1.62	0.681	1
4. They understand the existing laws and regulations to protect and nurture their innovations	0.158	0.26	0.061	1	1.3	0.777	1

** Correlation is significant at the 0.01 level (2-tailed).

In table 10 above, of the four factors only one pair was significant of ICT innovators that have been successful in monetizing their innovations and who do not have an entrepreneurial spirit and desire to innovate with a coefficient of -0.488. The negative relationship indicates an inverse relationship between

the two factors, which means that as much as innovators have entrepreneurial spirit and desire to innovate, they are not successful in monetizing their innovations and are not running profitable businesses.

It can also be noted that the descriptive statistics are in agreement that the only factor that shows strength is ICT innovators having an entrepreneurial spirit and desire to innovate with a mean of 3.95 and mode 3. The rest of the other factors have a mean less than 1 and mode 1.

b) Test of relationship

Test of relationship was carried out on the five innovators' factors against the demographic factors of level of education, citizenship, age, duration of work and gender.

The null hypothesis (H_0): There is no difference in views on ICT innovators and innovations in Kenya against demographic aspects

Alternative hypothesis (H_1): There is a difference in views on ICT innovators and innovations in Kenya against demographic aspects

Table 9 - Test of relationship between innovators and social demographics

Views on ICT innovators and innovations in Kenya	**Level of Education**			**Age**			**Duration**			**Gender**		
	χ^2	**df**	**p-value**	χ^2	**df**	**p-value**	χ^2	**df**	**p-value**	χ^2	**df**	**p-value**

They have an entrepreneurial spirit and desire to innovate							6.972	2 **0.031***
They know and understand how to value their innovations					31.45	8 **0.000****		
Over half of ICT innovators that you know have been successful in monetizing their innovations and are running profitable businesses			8.751	2 **0.013***				
They understand the existing laws and regulations to protect and nurture their innovations	18.32	6 **0.005****						

Note: p values ***:p≤ 0.05 **: p≤ 0.01**

Looking at Table 11 above, the four demographic factors thus level of education, age, duration and gender were tested for relationship against four innovator factors thus entrepreneurial spirit and desire to innovate, knowledge and understanding how to value their innovations', success in monetizing their innovations and running profitable businesses and 'understanding existing laws and regulations to protect and nurture their innovations. The respondents' views on entrepreneurial spirit and desire to innovate, was significantly related only to gender. This means that both male and female in equal measure have an entrepreneurial spirit and desire to innovate.

Variation in views test on ICT innovators and innovations in Kenya.

Man Whitney U test and Kruskal Wallis H test were used to test for variation in the responses above.

Kruskal Wallis is a One Way ANOVA on ranks and Man Whitney U test is an independent sample T Test on ANOVA.

Variation in views by level of education

H_o: Level of education does not affect ICT innovators and innovations in Kenya.

H_1: Level of education affects ICT innovators and innovations in Kenya.

For level of education, all the factors were insignificant meaning the rankings of the factors across the levels of education were same. The associated significance values for the test variable (independents) were all greater than 0.05 which means innovators have an entrepreneurial spirit and desire to innovate 0.431, they know and understand how to value their innovations 0.781, over half of ICT innovators that you know have been successful in monetizing their innovations and are running profitable businesses 0.549 and they understand the existing laws and regulations to protect and nurture their innovations 0.329.

The results above imply that level of education does not significantly affect the factors associated with ICT innovators and innovations in Kenya. Highest level of education has the lowest mean rank of 16.5 meaning education is a driving force in ICT innovators and innovations in Kenya.

Variation of views by citizenship

H_o: Citizenship does not affect ICT innovators and innovations in Kenya

H_1: Citizenship does affect ICT innovators and innovations in Kenya

With regard to citizenship, two independent sample test (Man Whitney) was carried. The factors that were significant were innovators have an entrepreneurial spirit and desire to innovate$\alpha = 0.038$ and for ICT innovators that have been successful in monetizing their innovations and are running profitable businesses$\alpha = 0.040$. This means citizenship does significantly affect these factors. Being a non-citizen ranks lowest meaning ICT innovators and innovations in Kenya rely on non-citizens.

Variation in views by age

H_o: Age does not affect ICT innovators and innovations in Kenya.

H_1: Age does affect ICT innovators and innovations in Kenya.

Over half of ICT innovators that have succeeded in monetizing their innovations and are running profitable businesses was significant meaning it is significantly affected by age. The ranking in age has lowest age bracket with least mean rank of 17.6. This means that younger persons are more likely to be innovative.

Variation of views by duration of working in a role

H_o: Duration of working in a role does not affect ICT innovators and innovations in Kenya.

H_1: Duration of working in a role does affect ICT innovators and innovations in Kenya.

Knowing and understanding how to value their innovations was significant meaning the duration one has been working on a particular IT role is a significant factor. The longer one stays in ICT related profession, the less the average, with one year having an average of 23, two years 23.6, 3 years 17.5, 4 years 19 and 5 years 18. This means that the higher the number of years one works in IT the better the innovation capacity.

Variation of views by gender

H_o: Gender does not affect ICT innovators and innovations in Kenya

H_1: Gender does affect ICT innovators and innovations in Kenya

With regard to gender, two independent sample test (Man Whitney) was carried. The associated significances were all insignificant, which means gender does not significantly affect ICT innovators and innovations in Kenya. In gender, females had the lowest mean ranking. Bas & Sierra (2012) argue that innovators may opt to migrate to a foreign country to carry out their innovation activities there based on the innovation- friendly policies of that country and support to foreign innovators to set up base in their country.

Table 10 - Factors influencing innovation

Rotated Component Matrix

Factors	Component 1	Component 2
They have an entrepreneurial spirit and desire to innovate		0.813
They understand the concepts of Intellectual capital (IC) and property rights (IPRs)	0.901	
They know and understand how to value their innovations	0.939	
Over half of ICT innovators that you know have been successful in monetizing their innovations and are running profitable businesses		-0.881
They understand the existing laws and regulations to protect and nurture their innovations	0.474	

Rotation Method: Varimax with Kaiser Normalization

From table 11 above, it can be seen that with regard to ICT innovators and innovation in Kenya, innovators knowing and understanding how to value their innovations loads highly on component one 0.939 and this indicates that it is the most significant factor influencing ICT innovations in Kenya. Understanding the concepts of Intellectual capital (IC) and property rights (IPRs) loads with 0.901, innovators having an entrepreneurial spirit and desire to innovate 0.813 and understanding the existing laws and regulations to protect and nurture their innovations 0.474.

The ICT innovators who have been successful in monetizing their innovations and are running profitable businesses has a negative 0.881. This indicates that in as much as innovators are innovating in ICT, they have not been successful in monetizing their innovations and are not running profitable businesses.

4.3 Qualitative analysis - Objective 1

For qualitative research the following verbatim comments from participants are relevant to objective 1.

'*Innovators must take the initiative to learn and be aware of the laws that exist to protect them from theft of their ideas*', said an IP lawyer. An accelerator service manager said '*We always tell innovators that they need to solve problems that are worth solving so that they can create viable businesses. Solutions and ideas that can be transformed into viable businesses will lead to success for the innovators and hence attract partners who can provide new ideas, networks and funding'.*

The Permanent Secretary for Ministry of ICT commented that '*the IP regime in Kenya is not well developed. We are working with the Ministry of Education to ensure that each University and college has research management units that understand IP issues well to disseminate them to their students. IP protection can enable Universities generate revenue. He also noted that even though Kenya has witnessed some growth in patent applications and grants, the number are still negligible when compared with global applications for patents. Only 2,388 patents were filed in the period 1990-2013 and few or no ICT patents from local innovators, which could point to their lack or little IP knowledge. Universities and colleges need to consider innovations and IP as part of their curriculum*'.

Another IP lawyer said 'As a country, *we need to build awareness as well as increase funding to ensure local IP protection. We, as a country should set up an intellectual property fund to assist innovators in training and application for patents. Kenya has limited capacity in professionals who can offer affordable services for patent drafting and application. Patent and IP protection should be qualitative in nature, she concluded'*.

An ICT practitioners in Kenya for twenty years noted that '*awareness on intellectual property has gradually improved but lack of enough experts with IP knowledge has undermine this noble initiative and hence many years later our innovators largely still lack in this very important knowledge'*.

4.4 Main findings for objective 1

In Figure 4, page 78, the response on the level understanding of the existing IP laws and how to convert innovations into viable business response shows a disconnect in the sense that innovators with their limited IP knowledge have not understood that IP protection is a source of competitiveness that can create value for their businesses. This finding is supported by the work of (Crumpton, 2012) who has linked entrepreneurship to innovation in the sense that innovation should lead to business and value creation and (Heunks, 1998), who said that innovation is followed by success in terms of profitable business and value creation. Knowledge and understanding of how to value their innovations is directly related to the duration of work, with experience, an innovator learns how to value their innovations. Success in monetizing innovations and are running profitable businesses was highly related with age, which is an indication that with age comes the knowledge of how to monetize innovations and run profitable businesses.

Understanding the existing laws and regulations to protect and nurture their innovations is significantly related to level of education, which means the higher the education, the most likely an innovators will know and have some form of understanding of IP. This finding is supported by (Dyke and Smither, 2004) in their research on age, gender and level of education and argue that that there were no age, gender and education differences in relation to entrepreneurial capability to innovate. However, (Timmermans, 2011) noted that diversity in knowledge, which come from years of experience has an impact on the business acumen and success of an innovator.

On strength of relationship analysis table 10, on page 79, there was a negative relationship between successful monetization of innovations and entrepreneurial flair and desire to innovate with a coefficient of -0.488. This means that not being able to make money from innovations affects that entrepreneurial journey of an innovator who does not find worth his or her while to innovate when he cannot successfully monetize his or her innovation.

Maidique and Zirger (1990) in their study of innovation and entrepreneurship identified a number of factors including market knowledge, optimized internal business processes, early market entry and financial management knowledge which underpin success for innovations and their entrepreneurial pursuits. This suggests therefore that for innovators, having an entrepreneurial flair is not enough, they have to understand the market for which they want to innovate and determine first hand, whether their innovations will solve real problems and hence the innovators can build profitable businesses.

From the test of relationship between innovators and social demographics, table 11 page 80-81, the respondents' views on entrepreneurial spirit and desire to innovate, was significantly related only to gender. This means that both male and female in equal measure have an entrepreneurial spirit and desire to innovate and women have as much a chance as males to innovate. In addition, the only factor that shows significant strength is ICT innovators having an entrepreneurial spirit and desire to innovate.

On pages 82-83, the strength of relationship between innovators and level of education, the higher the level of education the higher the level of innovation activity and focus on innovation that addresses The strength real needs and problems. The strength of relationship innovators and citizenship means that non-citizens are not discriminated in working on their innovations in Kenya, which would imply that non-citizens find the Kenyan environment suitable for their innovations activity. The strength of relationship between innovators and age shows that younger innovators are more likely to be involved in innovation activity than slightly older ones and this would be informed by the knowledge of new ICT tool for ICT innovation among the younger innovators. On innovator and working experience, the more years one has worked in a role, the better the results they get, which means such innovators get experience in managing innovator teams and getting results than younger innovators. Finally on innovators and gender, gender does have a significant impact and male or female stand have chances of succeeding in their innovations.

In factor analysis on factors influencing innovation with regard to innovators and their knowledge. A component one score of 0.939 as per Table 12, page 84 indicates that knowledge is the most significant factor influencing innovators. It also shows a direct correlation between success in monetizing innovations and running profitable business.

On qualitative research, the respondents said that more work remains to be done on the IP ecosystem in Kenya, from laws, training, awareness and ease of application and management of the IP application process. The setting up of an IP fund with support from government and private sector business would assist in this regard, page 84-85.

These findings are supported by the work of Soeterndorp (2004) who argues that IP competence can assist organizations and individuals to take advantage of opportunities presented by new and accelerating developments in the knowledge economy. Most professional bodies have recognized and acknowledged the importance of IP competence as an enterprise skill for new graduates (Bessen, 2003). Most universities are rethinking their undergraduate curricula to incorporate units in IP to enhance students' entrepreneurial skills.

Stiglitz (2014) posits that, the pace of innovation is related both to IP knowledge as well as investment, which creates an endogenous relationship. Investments in innovations are affected by IP knowledge and the ability of innovators to appropriate returns of their innovative activity, in which the IP regime is important. The strength, knowledge and design of IP affects the extent to which any innovation adds to or subtracts value for the innovator and hence supports the commercially viability of the innovation (Aghion, 2014).

4.5 Quantitative analysis - Objective 2

The role and support of international ICT companies in Kenyan ICT innovators with focus on IPs

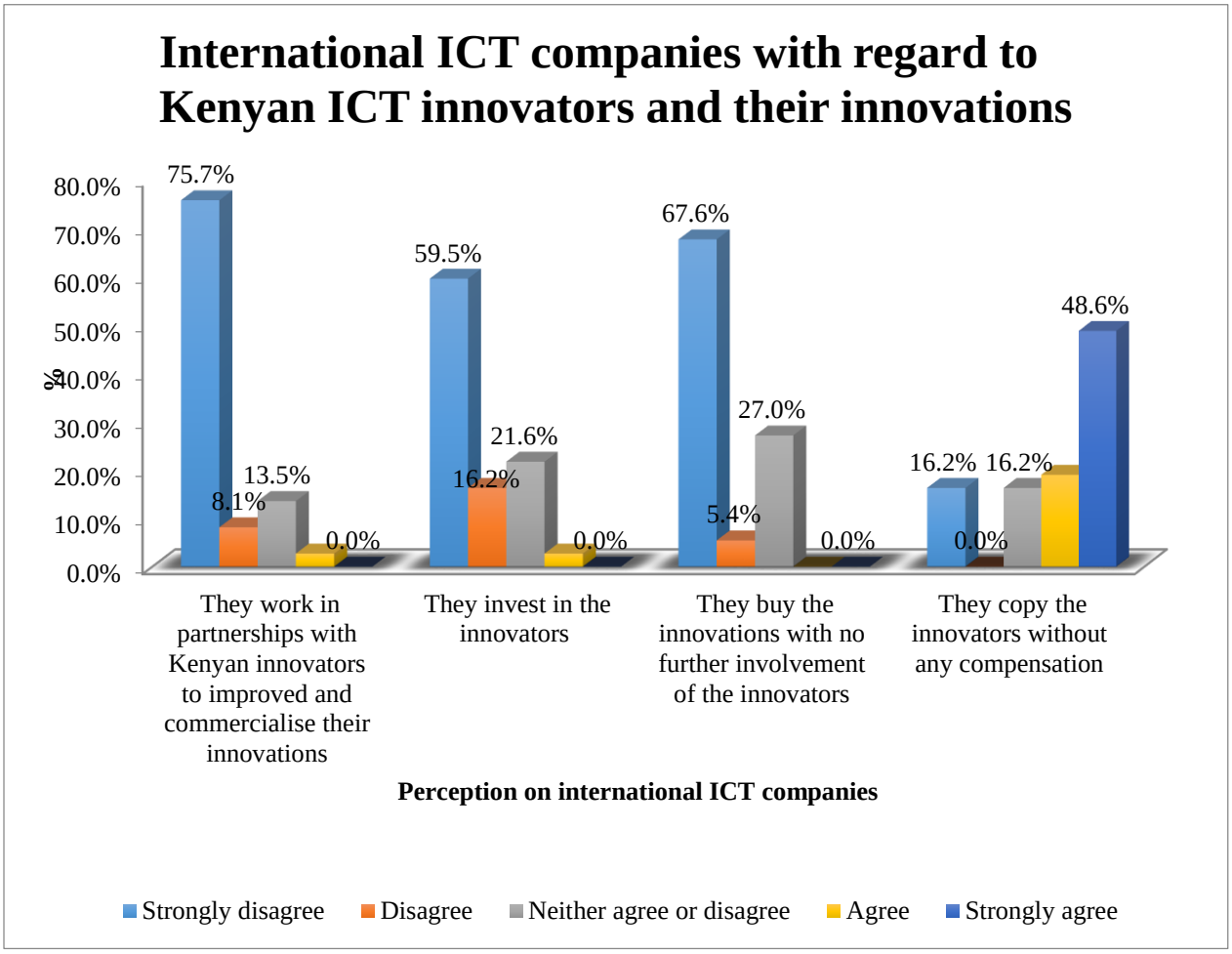

Figure 5 - Perception of international ICT companies

From figure 5 above, only one factor of international ICT companies copying the innovators without any compensation showed agreement at 67.6%. The rest of the concepts had over 70% disagreement on the role and support of international ICT companies in Kenyan ICT innovators.

a) Strength of relationship analysis

Table 11 - Descriptive statistics and correlation analysis on international ICT companies

Descriptive Statistics and Correlation Analysis (n=37)

International ICT companies with regard to Kenyan ICT innovators and their innovations	**1**	**2**	**3**	**4**	**Mean**	**SD**	**Mode**
1.They work in partnerships with Kenyan innovators to improved and commercialize their innovations	1				1.43	0.835	1
2. They invest in the innovators	**.589****	1			1.68	0.915	1
3. They buy the innovations with no further involvement of the innovators	0.241	0.174	1		1.59	0.896	1
4. They copy the innovators without any compensation	-0.009	-0.04	0.224	1	3.84	1.463	5

** Correlation is significant at the 0.01 level (2-tailed)

From table 13 above on international ICT companies with regard to Kenyan ICT innovators and their innovations, the relationship, was significant between two factors where those who said the companies invest in the innovators also said they work in partnerships with Kenyan innovators to improve and commercialize their innovations. This had a strong positive correlation coefficient of 0.589, which means the ICT companies invest in the innovators and work in partnerships with Kenyan innovators to improve and commercialize their innovations. The factor that was highly rated though it was not significant with the others was that innovators feel international ICT companies copy their innovators without any compensation with a mode of 5.

b) Test of relationship

H_0: There is no difference in views of international ICT companies working in partnerships with Kenyan innovators

H_1: There is no difference in views of international ICT companies working in partnerships with Kenyan innovators.

Table 12 - Test of independence for international ICT companies and innovators

International ICT companies with regard to Kenyan ICT innovators and their innovations	**Level of Education**			**Age**			**Duration**			**Gender**		
	χ^2	**df**	**p-value**	**χ^2**	**df**	**p-value**	**χ^2**	**df**	**p-value**	**χ^2**	**df**	**p-value**
They work in partnerships with Kenyan innovators to improved and commercialize their innovations	42.053	6	**0.000****				44.249	12	**0.000****			
They invest in the innovators	38.385	6	**0.000****				50.244	12	**0.000****			
They buy the innovations with no further involvement of the innovators												
They copy the innovators without any compensation							25.948	12	**0.011****			

Note: p values ***:p≤ 0.05 **: p≤ 0.01**

From Table 14 above, the four demographic factors - level of education, age, duration and gender were tested for relationship against four research questions on International ICT companies. The sigficant factors were working in partnerships with Kenyan innovators to improve and commercialize their innovations, 'Investing in the innovators, buying the innovations with no further involvement of the innovators and copying the innovators without any compensation.

Variation in views of International ICT companies with regard to Kenyan ICT innovators and their innovations

The null hypothesis

(H_0) that the four factors on International ICT companies with regard to Kenyan innovators do not affect the four demographic factors.

(H_1): The four factors on International ICT companies with regard to Kenyan ICT innovators do affect five critical factors

On level of education, the factor, were insignificant meaning level of education does not significantly affect these factors. Post graduate degree holders had the lowest ranking followed by university degree meaning the higher the level of education, the higher the chance of an innovator having support or investment from an International ICT company. On citizenship, the factor that was significant was that International ICT companies buy the innovations with no further involvement of the innovators $\alpha = 0.032$. This means citizenship does significantly affect this factor. Non-citizens had the lowest ranking meaning non-citizens have higher attachment to International ICT companies.

Age had two concepts significant, they work in partnerships with Kenyan innovators to improve and commercialize their innovations $\alpha = 0.032$ and they invest in the innovators $\alpha = 0.047$. This means, the age does significantly affect these factors. Younger age had the lowest ranking meaning the lower the age, the higher the chance of an innovator of getting support from an International ICT company.

On duration in their current role, the factor that was significant was the international companies copy the innovators work without any compensation, $\alpha = 0.039$. The higher the number of years in the current role the lower the rankings meaning for innovators with a few years in innovations, they are likely to loose their innovations to international companies without any compensation.

Regarding gender, the factors were insignificant, which means gender does not significantly affect the factors on international companies. In gender, the females had the lowest ranking meaning females have higher attachment to International ICT companies.

Factors influencing International ICT companies with regard to Kenyan ICT innovators and their innovations

Table 13 - Factor analysis of international ICT companies

Factors	Component	
	1	2
They work in partnerships with Kenyan innovators to improve and commercialize their innovations	0.876	
They invest in the innovators	0.875	
They buy the innovations with no further involvement of the innovators		0.713
They copy the innovators without any compensation		0.840

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

From table 15 above, the factor that loaded highly and which was most significant is international ICT companies working in partnerships with Kenyan innovators to improve and commercialize their innovations 0.876. Investing in innovators was another factor, which was a great influencer 0.875. Buying of innovations and not involving innovators further on the part of international ICT companies showed least influence.

4.6 Qualitative analysis - Objective 2

For qualitative research the following comments from participants are relevant for objective 2.

The Permanent Secretary for Ministry of ICT said that '*There is great potential in Africa but unfortunately knowledge harnessing is not being done in a structured and holistic manner and where it is done, it is by foreign companies who sometimes take advantage of our innovators. Science, technology and innovation cannot be divorced from intellectual property. IP is indispensable for transforming knowledge into assets and innovators must understand this. Probably an interagency approach could address this challenge!*'

An IP lawyer commented that '*IP institutions are weak and are prone to being taken advantage of by entities from without. They need support. Kenya needs support to re-design national laws for effective exploitation of ICT related IP*.'

An accelerator service manager argued that '*it is sad that some innovators have lost their work to foreign entities, I would advise them to treat the loss as part of learning and to know that constant trying and persistence begets excellence and success especially in protecting their innovations. Innovators must never be depressed by failure, they must rise up and try again. There are examples of many global examples of such failures that eventually became global success stories'*.

4.7 Main findings for objective 2

Most governments put in place favourable policies to attract and retain foreign investment to their countries. The companies that take advantage of such favourable policies, may set up their businesses by partnering with local companies, setting up businesses afresh or partnership and collaboration. The objective of role and support of international ICT companies for Kenyan ICT innovators is based on the fact that Kenya attracts such ICT companies.

In figure 5 page 89, on the relationship between innovators and international companies, innovators disagree that they get support from such companies, that the companies do not invest in their innovations and mostly buy their innovations and do not involve further and also copy their innovations without adequate compensation. This would mean that on the whole international ICT companies need to improve on their supportive role to Kenyan innovators and would need to be part of an ecosystem that supports the innovators.

On strength of relationship analysis, table 13 page 90, the factor that is highly rated is that innovators feel international ICT companies copy their innovators without any compensation. On strength of relationship with the demographic factors - level of education, age, duration and gender and despite the observation that on the whole, international ICT companies need to do better for Kenyan innovators, the factor of working in partnerships with Kenyan innovators to improve and commercialize their innovations was significant to the level of education and duration one has worked, which means International ICT companies seem to value the level of education and work experience of innovators especially on how to improve and commercialize their innovations. Investing in the innovators was significant to level of education and work experience, which would mean International ICT companies look for level of education and work experience when they want to identify which innovator to work with in. Copying the innovators without any compensation was significant to work experience meaning the companies are looking for innovators with more experience in business and innovations from who they are likely to copy innovations without any compensation

From the analysis above and according to Maurer (2010) the longer the work experience, it means the innovator has become better at ensuring the innovation solves a practical problem and is therefore able to build trust and likely to find support and investment from an international or global partner.

In page 91, the test of independence of international ICT companies against the four demographic factors of level of education, age, duration and gender, the significant factors were working ICT companies in partnerships with Kenyan innovators to improve and commercialize their innovations, investing in the

innovators, buying the innovations with no further involvement of the innovators and copying the innovators without any compensation. Which means innovators have had different experiences in their engagements with international ICT companies.

Regarding hypothesis testing on the four demographic factors and International ICT companies on page 92, age and duration of work were significant and level of education and gender we insignificant.
On factor analysis on table 15, page 93, the highest factor had a score of 0.876 and it demonstrates the desire of Kenyan innovators to partner with international companies to improve and commercialize their innovators.

On qualitative analysis, The Principal Secretary for ICT was of the view that a structured and inter agency approach for engagement between innovators and international companies is necessary and government through its agency in charge of issuing patents could develop an information clearing house, that would enable and educate innovators on what information to share they should share with international companies to avoid giving too much information that lead to them losing their ideas.

An IP lawyer argues that, there is need for more robust IP laws to support local innovators. More IP lawyers should offer pro bono services to innovators to stem the loss of innovations.

These findings are supported by Simmie (2004), who posits that innovation is the key driver of competitiveness and productivity, a country's innovation clusters are part of a global network that links innovations to economic growth. The presence and support of international ICT companies to local innovators therefore fits in this landscape.

Xiaolan, Pietrobelli and Soete (2011), argue that, despite the great potential offered by globalization, the benefits of international technology diffusion should be delivered in parallel with local innovation efforts and the presence of modern institutional and governance structures and conducive innovation systems. This is further compounded sometime by the lack of relevance of technologies from countries in the West for the developing world, which call for greater efforts in development of local innovations with global support. Mahmood and Ruffin (2016) argue that multinationals can supplement government efforts in the development of appropriate innovations.

4.8 Quantitative analysis - Objective 3

Explore government's role in supporting ICT innovations and protecting the innovators through enforcement of IP laws

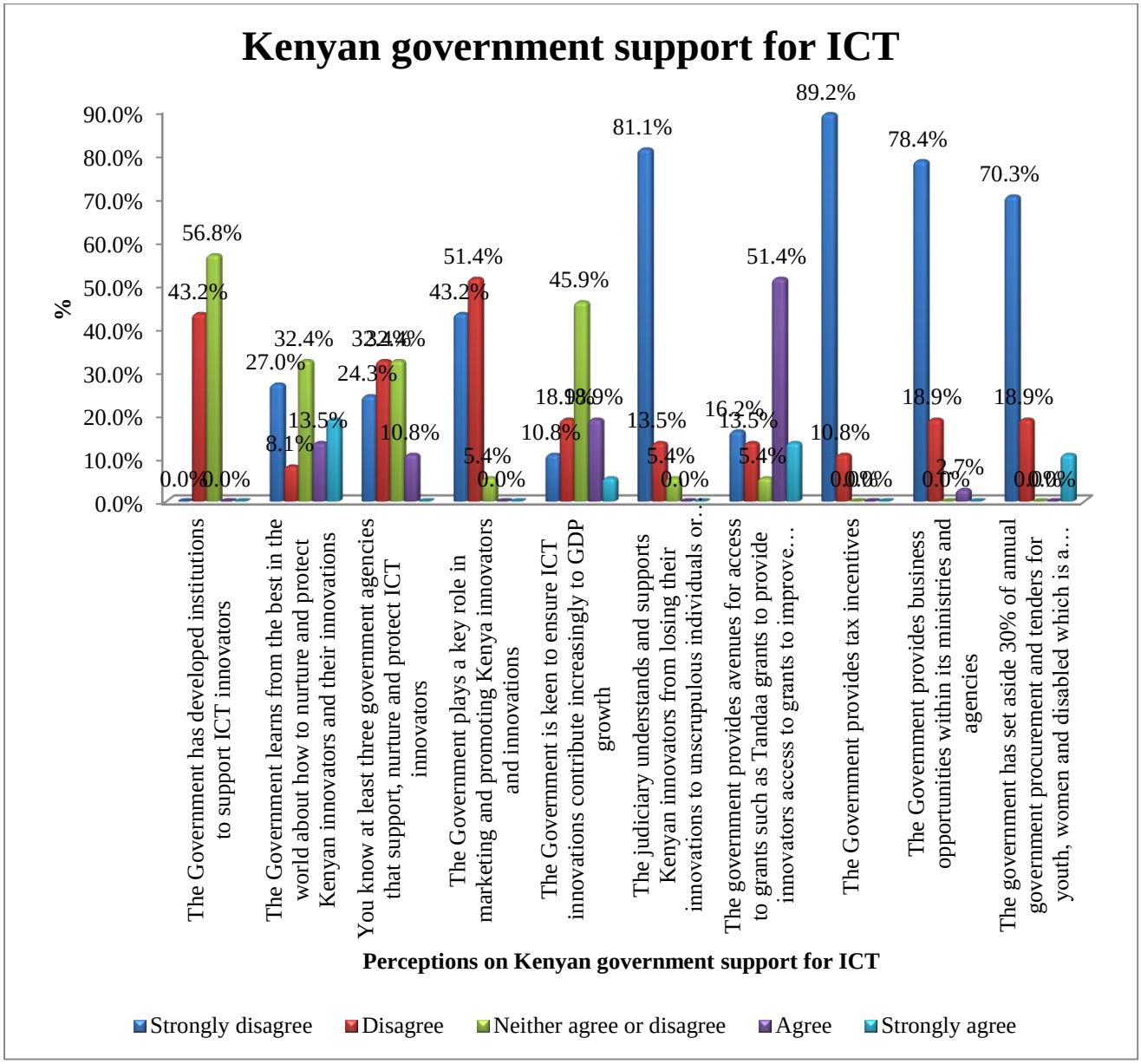

Figure 6 - Perceptions on Kenya government support for ICT

Table 14 - Kenya government for ICT innovators

Kenyan government support for ICT	Disagree	Agree	Neither
The Government has developed institutions to support ICT innovators	43.2%	0.0%	56.8%
The Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations	35.1%	32.4%	32.4%
You know at least three government agencies that support, nurture and protect ICT innovators	56.7%	10.8%	32.4%
The Government plays a key role in marketing and promoting Kenya innovators and innovations	94.6%	0.0%	5.4%
The Government is keen to ensure ICT innovations contribute increasingly to GDP growth	29.7%	24.3%	45.9%
The judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations	94.6%	0.0%	5.4%
The government provides avenues for access to grants such as Tandaa grants to provide innovators access to grants to improve their innovations	29.7%	64.9%	5.4%
The Government provides tax incentives	100.0%	0.0%	0.0%
The Government provides business opportunities within its ministries and agencies	97.3%	2.7%	0.0%
The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for us	89.2%	10.8%	0.0%

From Figure 6 and Table 16 above, except on the factor of government providing avenues for access to grants innovators with an agreement of 64.9%, on the rest of factors, the respondents were indifferent.

The rest of the factors showed disapproval of the government support to the ICT sector. Most notable were government providing tax incentives 100%, government providing business opportunities within its ministries and agencies 97.3%, judiciary understanding and supporting Kenyan innovators from losing their innovations to unscrupulous individuals or organizations 94.6%, The government playing a key role

in marketing and promoting Kenya innovators and innovations 94.6% and Government setting aside 30% of annual government procurement and tenders for youth, women and disabled 89.2%.

a) Strength of relationship analysis

Table 15 - Strength of relationship analysis

Descriptive Statistics and Correlation Analysis (n=37)													
Kenyan government support for ICT	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Mean**	**SD**	**Mode**
1. The Government has developed institutions to support ICT innovators	1										2.57	0.502	3
2. The Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations	0.201	1									2.89	1.449	3
3. You know at least three government agencies that support, nurture and protect ICT innovators	0.043	**.717****	1								2.3	0.968	2
4. The Government plays a key role in marketing and promoting Kenya innovators and innovations	**-.564****	-0.178	0.056	1							1.62	0.594	2
5. The Government is keen to ensure ICT innovations contribute increasingly to GDP growth	0.177	**.649****	**.595****	0.022	1						2.89	1.022	3
6. The judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations	**-.516****	**-.456****	-0.297	**.547****	-0.249	1					1.24	0.548	1
7. The government provides avenues for access to grants such as Tandaa to provide innovators access to grants to improve their innovations	**.381***	**.809****	**.611****	-0.23	**.658****	**-.567****	1				3.32	1.334	4
8. The Government provides	**-.399***	-	**-.382***	0.076	-0.135	**.326***	**-.416***	1			1.11	0.315	1

tax incentives		**.461****											
9. The Government provides business opportunities within its ministries and agencies	-0.243	**-.376***	**-.376***	0.137	**-.399***	0.214	-0.15	0.279	1		1.27	0.608	1
10. The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for us	-0.267	**-.481****	**-.476****	0.138	**-.379***	**.622****	**-.572****	0.036	**.466****	1	1.62	1.255	1

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed).

From table 17 above, the Kenyan government support for ICT does not seem to be strong as most of the factors are negatively significant. For respondents who said they know at least three government agencies that support, nurture and protect ICT innovators they also said the government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations this is indicated by a strong positive correlation coefficient of 0.717.

Respondents who said the Government plays a key role in marketing and promoting Kenya innovators and innovations they said the Government has not developed institutions to support ICT innovators indicated by a strong negative correlation coefficient of 0.564. This means that in as much Kenyan government plays key role in marketing and promoting Kenyan innovators, it does has not developed institutions to protect and support ICT innovators.

Innovators who said the Government is keen to ensure ICT innovations contribute increasingly to GDP growth also said the Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations indicated by a strong positive correlation coefficient of 0.649 and they know at least three government agencies that support, nurture and protect ICT innovators indicated by a strong positive correlation coefficient of 0.595.

Judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations and the Government has not developed institutions to support ICT innovators indicated a strong negative correlation coefficient of 0.516, Government does not learn from the best in the world about how to nurture and protect Kenyan innovators and their innovations indicated by a strong

negative correlation coefficient of 0.564 and the Government plays a key role in marketing and promoting Kenya innovators and innovations indicated by a strong positive correlation coefficient of 0.547.

Those who said the government provides avenues for access to grants to provide innovators access to grants to improve their innovations also said the Government has developed institutions to support ICT innovators indicated by a strong positive correlation coefficient of 0.381, the Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations indicated by a strong positive correlation coefficient of 0.809, they know at least three government agencies that support, nurture and protect ICT innovators indicated by a strong positive correlation coefficient of 0.611, the Government is keen to ensure ICT innovations contribute increasingly to GDP growth indicated by a strong positive correlation coefficient of 0.658 and the judiciary does not understand and doesn't support Kenyan innovators from losing their innovations to unscrupulous individuals or organizations indicated by a strong negative correlation coefficient of 0.567. This factor was also highly rated with a mode of 4.

The respondent who were of the view that the government provides tax incentives, said the government has not developed institutions to support ICT innovators indicated by a strong negative correlation coefficient of 0.399, the Government does not learn from the best in the world about how to nurture and protect Kenyan innovators and their innovations indicated by a strong negative correlation coefficient of 0.461, they do not know at least three government agencies that support, nurture and protect ICT innovators indicated by a strong negative correlation coefficient of 0.382, judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations indicated by a strong positive correlation coefficient of 0.326 and the government doesn't provide avenues for access to grants to provide innovators access to grants to improve their innovations indicated by a strong negative correlation coefficient of 0.416.

On Government providing business opportunities within its ministries and agencies, they said the Government doesn't learn from the best in the world about how to nurture and protect Kenyan innovators and their innovations indicated by a strong negative correlation coefficient of 0.376, they don't know at least three government agencies that support, nurture and protect ICT innovators indicated by a strong negative correlation coefficient of 0.376 and the Government is not keen to ensure ICT innovations contribute increasingly to GDP growth indicated by a strong negative correlation coefficient of 0.399.

With regard to those who said the government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for them, they said the Government does

not learn from the best in the world about how to nurture and protect Kenyan innovators indicated by a strong negative correlation coefficient of 0.481. Those that do not know at least three government agencies that support, nurture and protect ICT innovators indicated by a strong negative correlation coefficient of 0.476. The Government is not keen to ensure ICT innovations contribute increasingly to GDP growth indicated by a strong negative correlation coefficient of 0.379, the judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations indicated by a strong positive correlation coefficient of 0.622, the government does not provide avenues for access to grants such as Tandaa grants to provide innovators access to grants to improve their innovations indicated by a strong negative correlation coefficient of 0.572 and the Government provides business opportunities within its ministries and agencies indicated by a strong positive correlation coefficient of 0.466.

From the above results, it can be seen that the government is not doing enough to support ICT innovators except only in the area of assisting innovators get to grants and which are subject of competition which means there are many innovators who will not get the chance to access the grants.

b) Test of relationship

H_0: There is no difference in views for Kenyan government support for ICT

H_1: There is a difference in views for Kenyan government support for ICT

Table 16 - Test of independence for Kenya government support of innovators

Kenyan government support for ICT	**Level of Education**			**Age**			**Duration**			**Gender**		
	χ^2	**df**	**p-value**	**χ^2**	**df**	**p-value**	**χ^2**	**df**	**p-value**	**χ^2**	**df**	**p-value**
The Government has developed institutions to support ICT innovators												
The Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations	17.267	8	**0.027***				28.661	16	**0.026***	10.59	4	**0.032***
You know at least three government agencies that support, nurture and protect ICT innovators							21.596	12	**0.042***	11.609	3	**0.009****
The Government plays a key role in marketing and promoting Kenya innovators and innovations	18.035	4	**0.001****				19.443	8	**0.013***			
The Government is keen to ensure ICT innovations contribute increasingly to GDP growth										10.794	4	**0.029***
The judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations	20.35	4	**0.000****	6.578	2	**0.037***	26.84	8	**0.001****			
The government provides avenues for access to grants such as Tandaa grants to provide innovators access to grants to improve their innovations							34.357	16	**0.005****	10.059	4	**0.039***
The Government provides tax incentives	17.478	2	**0.000****									
The Government provides business opportunities within its ministries and agencies										6.213	2	**0.045***
The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for us	9.809	4	**0.044***				26.981	8	**0.001****	6.176	2	**0.046***

Note: p values ***:p≤ 0.05 **: p≤ 0.01**

From Table 18 above, ten factors regarding the Kenyan government support for ICT were tested against the four demographic characteristics. Except for the factor 'The Government has developed institutions to support ICT innovators', where all the demographic associations showed there were no differences in government support for ICT.

The factor on government learning from the best in the world about how to nurture and protect Kenyan innovators and their innovations was significantly associated with level of education, innovation experience and gender. In essence, this means that across levels of education, duration and gender there is a feeling that the government does not learn from the best in the world on how to nurture and protect Kenyan innovators. The factor on knowledge of government agencies that support, nurture and protect ICT innovators was significantly associated with innovation experience and gender. It there follows that there are varied views across duration and gender, who have no knowledge of government agencies that support, nurture and protect their innovations.

The factor of government playing a key role in marketing and promoting Kenya innovators and innovation was significant to level of education and duration. This means there are varied views across levels of education and duration in regard to the government playing key role in marketing and promoting Kenya innovators and innovation.

The government desire to have ICT innovations contribute increasingly to GDP growth was significant to gender. This means there are varied views across gender with regard to government being keen to ensure ICT innovations contribute to GDP growth. For the judiciary knowledge and support to innovators to protect them from losing their innovations to unscrupulous individuals or organizations, this research question was significantly associated to level of education, age and innovation experience. It follows that across levels of education, age and innovation experience, there is a feeling that the judiciary does not understand and support Kenyan innovators from losing their innovations to unscrupulous individuals or organizations.

The research question about government providing avenues for access to grants for innovators to improve their innovations was significantly associated to innovation experience and gender. This means across duration and gender, the government does not provide avenues for access to grants to assist the innovators in improve their innovations. Government provision of tax incentives was significant to the level of education, which means that across different the different levels of education, the government does not provide appropriate tax incentives. The Government providing business opportunities within its ministries

and agencies was significant to gender which means across gender, there is a feeling that government does not provide business opportunities within its ministries and agencies.

The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for innovators, was significant to level of education, duration and gender. This means across levels of education, duration and gender, there is a feeling that government has not set aside 30% of annual government procurement and tenders for youth, women and disabled which would have government buy some of the innovations for its own use.

c) Variation in views on Kenyan government support for ICT

(H_0) that the four concepts on Kenyan government support for ICT do not affect ten critical factors

(H_1) the four concepts on Kenyan government support for ICT does affect ten critical factors

The research question on judiciary's understanding and support of innovators from losing their innovations was significant with $\alpha = 0.029$ and the government provision of tax incentives with $\alpha = 0.000$ meaning level of education significantly affects these factors. Persons with lowest level of education have the lowest ranking mean and they agree with the research question on Kenyan government support for ICT innovators.

Regarding citizenship, the only one research question that was significant was government learning from the best in the world about how to nurture and protect Kenyan innovators and their innovations $\alpha = 0.047$. This means that citizenship has a significant impact and more Kenyan innovators would like to see their government doing more to gain better knowledge on how to protect them. Non-citizens have the lowest ranking meaning they agree with Kenyan government support for ICT.

For age, government plays the key role in marketing and promoting Kenya innovators and innovations with $\alpha = 0.029$, government, provides business opportunities within its ministries $\alpha = 0.05$, judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations significant with $\alpha = 0.012$ and government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for us with $\alpha = 0.036$.

This means age significantly does affect this concepts. Persons with lower age have the lowest ranking which means that they agree with Kenyan government support for ICT innovators.

On duration, the demographic factors that were significant were - government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations $\alpha = 0.047$, knowledge of at least three government agencies that support, nurture and protect ICT innovators $\alpha = 0.016$, judiciary understands and supports, Kenyan innovators from losing their innovations $\alpha = 0.033$, government provides avenues for access to grants $\alpha = 0.017$ and government has set aside 30% of annual government procurement and tenders for youth, women and disabled $\alpha = 0.003$. This means innovation experience significantly affects the research questions. Respondents with lower number of working years have the lowest ranking mean they agree with Kenyan government support for ICT.

On gender, the demographic factors that were significant were the government learning from the best in the world about how to nurture and protect Kenyan innovators and their innovations $\alpha = 0.011$, knowledge of at least three government agencies that support, nurture and protect ICT innovators $\alpha = 0.004$, the government interest in ensuring ICT innovations contribute increasingly to GDP growth $\alpha = 0.042$, government providing grants for innovators to improve their innovations $\alpha = 0.042$ and government has set aside 30% of annual government procurement and tenders for youth, women and disabled which would be a great boost for innovators $\alpha = 0.046$. This means gender significantly affects the responses to these research questions. Respondents with lower number of working years have the lowest ranking, which means they agree with Kenyan government support for ICT. Males have the lowest ranking meaning they agree with Kenyan government support for ICT.

Table 17 - Analysis of factors influencing government support for innovators

Factors	Component		
	1	2	3
The Government has developed institutions to support ICT innovators		-0.797	
The Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations	0.820		
You know at least three government agencies that support, nurture and protect ICT innovators	0.828		
The Government plays a key role in marketing and promoting Kenya innovators and innovations		0.859	

The Government is keen to ensure ICT innovations contribute increasingly to GDP growth	0.809		
The judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations	-0.429	0.757	
The government provides avenues for access to grants such as Tandaa grants to provide innovators access to grants to improve their innovations	0.760		
The Government provides tax incentives			-0.888
The Government provides business opportunities within its ministries and agencies	-0.529		
The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for us	-0.740		

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

From the table 19 above, Government support for ICT innovators loaded and on three factor components. The question on government providing tax incentives, loaded highly negative -0.888. This means whereas providing tax incentives is an important factor, the government is doing little to ensure the tax incentives are implemented. The government role in marketing and promoting Kenya innovators and innovations had the highest positive loading of 0.859 indicating the government does a good job in addressing this. The government learning from the best in the world about how to nurture and protect Kenyan innovators and their innovations had a positive loading of 0.820 meaning the government has done a lot in addressing this area.

4.9 Qualitative analysis - Objective 3

For qualitative research the following comments from participants are relevant for objective 3.

An ICT practitioner argued that '*Governments the world over have resources to undertake risks – look at the flight to the moon and other planets! Private businesses cannot afford such ventures, but are able to ride the success made by government to create business opportunities. Look at what Richard Branson has done with the tourist rides to the moon and other planets. He could only do that after governments had demonstrated that it is possible! The role of government in underwriting risks in discovery or breaking new ground cannot be over-emphasized*!' Another ICT practitioner reasoned that '*governments have a duty to provide an enabling environment for business and ICT innovators are no exception, especially since government wants to mainstream ICTs through Vision 2030'.*

The Permanent Secretary in the ministry of ICT argues that '*government must adopt the triple helix model to bring together government, innovators (together with financiers) and academia to ensure the innovations are focused on solving real problems. I want to see what I can do to make this happen. I think Kenyan innovators can also access foreign markets if they registered on a portal, which government will market international*'.

The Director of KIPI indicated that '*the country has a low IP awareness and the pace of innovations does not match the pace of applications for patents, which may lead to 'innovator burn out' and this is not only unsustainable but not good for the economy. There is need for government research institutions and universities to have innovation ambassadors to assess research and determine research products that are suitable for patent protection'.*

An IP lawyer commented thus '*the government must enforce the IP and copyright laws that have been enacted by parliament to save the innovators from losing their innovations and get restitution when they loose the innovation through copyright infringements*!' Yet another IP lawyer indicated that '*The laws the country has on copyrights and intellectual property are sufficient to at-least deter theft of IP and copyrights. Enforcement is key!'.*

Cooke (1995) argues that governments and national authorities have a role to spur and promote innovation not only for economic growth but also for the social role of job creation and tax incentives for offering internships in order to have qualified manpower. Such support by governments gives innovators competitive advantage in terms of price and skilled labour for globally competitive business opportunities. Demirel and Kesidou (2011) also posit that government have the power to formulate appropriate policy and regulations towards supporting innovations.

Gould and Gruben (1996) in their research on the role of intellectual property rights in economic development have argued that evidence suggests that intellectual property protection is a significant determinant of economic growth. Etzkowitz (2008) in his discussion of the triple helix model of university-industry-government interactions on which increasingly innovation is underpinned, argues that government acts as public entrepreneurs and venture capitalists in addition to their traditional regulatory role in setting the rules of the game.

These analysis results support the need for the government to support ICT innovators on Intellectual property rights (IPRs) to ensure innovators understand their rights and laws and regulations relating to IPs

are enforced. Martin (2000) argues that Effective IP protection requires not only a reliable system of grant and administration but equally important an effective system of enforcement and that IP that cannot be properly and timely enforced is of limited value. Insufficiencies of enforcement are detrimental to the encouragement of research and development and the growth of Foreign Direct Investments (FDIs) thus negatively affecting the Kenyan economy (Cooke, 1995).

4.10 Main findings for objective 3

On the perception of government support to ICT innovators figure 6 page 97, the innovators strongly disagree with the factors that the judiciary understands and supports them from losing their innovations, that government provides avenues for financial grants to the, no government tax incentives and the governments does not offer them business opportunities within its agencies and does not offer preferential government procurement terms.

On strength of relationship analysis on table 17 page 99-100, the respondents said the government is keen to market and promote Kenya innovations and innovations but it has not developed the institutions that would support them in this regard. The government also wants ICT innovators to contribute to GDP but needs to do more to learn from the best around the world.

It can be seen that the government is not doing enough to support ICT innovators except only in the area of assisting innovators get some grants and which are subject to intense competition which means there are many innovators who will not get the chance to access the grants and the grants themselves are small in nature, in the region of USD 5,000.

On Government providing business opportunities within its ministries and agencies, they said the Government doesn't learn from the best in the world about how to nurture and protect Kenyan innovators and their innovations indicated by a strong negative correlation coefficient of 0.376, they don't know at least three government agencies that support, nurture and protect ICT innovators indicated by a strong negative correlation coefficient of 0.376 and the Government is not keen to ensure ICT innovations contribute increasingly to GDP growth indicated by a strong negative correlation coefficient of 0.399.

The factor on government learning from the best in the world about how to nurture and protect Kenyan innovators and their innovations was significantly associated with level of education, innovation experience and gender. In essence, this means that across levels of education, duration and gender there is a feeling that the government does not learn from the best in the world on how to nurture and protect Kenyan innovators. The factor on knowledge of government agencies that support, nurture and protect ICT innovators was significantly associated with innovation experience and gender. It there follows that there are varied views across duration and gender, who have no knowledge of government agencies that support, nurture and protect their innovations

The factor of government playing a key role in marketing and promoting Kenya innovators and innovation was significant to level of education and duration. This means there are varied views across levels of education and duration in regard to the government playing key role in marketing and promoting Kenya innovators and innovation.

The government desire to have ICT innovations contribute increasingly to GDP growth was significant to gender. This means there are varied views across gender with regard to government being keen to ensure ICT innovations contribute to GDP growth. For the judiciary knowledge and support to innovators to protect them from losing their innovations to unscrupulous individuals or organizations, this research question was significantly associated to level of education, age and innovation experience. It follows that across levels of education, age and innovation experience, there is a feeling that the judiciary does not understand and support Kenyan innovators from losing their innovations to unscrupulous individuals or organizations.

The research question about government providing avenues for access to grants for innovators to improve their innovations was significantly associated to innovation experience and gender. This means across duration and gender, the government does not provide avenues for access to grants to assist the innovators in improve their innovations. Government provision of tax incentives was significant to the level of education, which means that across different the different levels of education, the government does not provide appropriate tax incentives. The Government providing business opportunities within its ministries and agencies was significant to gender which means across gender, there is a feeling that government does not provide business opportunities within its ministries and agencies.

The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for innovators, was significant to level of education, duration and gender. This means across levels of education, duration and gender, there is a feeling that government has not set aside 30% of annual government procurement and tenders for youth, women and disabled which would have government buy some of the innovations for its own use.

From table 19 page 106-107, on factor analysis the factor on government being keen to increase the GDP component of ICT innovations had a high score of 0.809, however this intention is not backed by action since government does set aside preferential business opportunities for innovators and less privileged with a high negative score of -0.740.

The judiciary's role of protecting innovators from losing their innovations had two loadings one positive and the other negative which is a clear indication that this is an area that is not being adequately addressed. Access to government grants had a positive loading factor a clear indication government is adequately addressing this area. The provision of business opportunities by government had a negative loading of 0.529 and indication government is doing little in buying innovations from Kenyans for its own use.

On the qualitative analysis, The Kenya Industrial Property Institute is of the view the innovators are applying to patent incomplete solutions and also lack capacity to go through the application process. The role of government, academia and business needs to be amplified to ensure a working relationship that supports innovators in their work and how to protect it as well as developing innovations that address real issues for government and the larger business community.

5 Implications for IP policy and practice

The IP created in Kenya is a source of value to the innovators and the government. It is therefore imperative that the government actively seeks to optimize the IPs economic, social and environmental benefits to the country.

5.1 Objectives

The IP policy objectives include the protection of the rights of innovators, funders, sponsors, and the general public, the elimination of infringement, improper exploitation and abuse of IP assets to the detriment of innovators and government. There is also the need to identify and promote linkages industry and to stimulate industry led innovation and research to ensure innovations solve real business challenges. Lastly is the need to ensure responsible management and fair and equitable distribution of benefits accruing from innovations among innovators.

5.2 Principles

In furtherance of the policy objectives, the government and innovators will work to ensure proper manage and utilization of IP to enhance delivery of services to government, general public and for export. To preserve and enhance the operational value of IP and to work in cooperation between government and innovators. To adopt an appropriate risk management framework, IP dispute resolution mechanisms and best practice in the commercialization and management of IP.

5.3 Practice

The Management of IP revolves around technology transfer between government and innovators and among innovators to ensure appropriate value is maintained in such transaction. Such value ensures that services from such innovations remains affordable to the general public. The allocation of IP to innovators and international IP cooperation between and among countries and innovators leads to further IP growth. Other components of IP management are detailed below.

5.3.1 Institutions, collaboration and learning

The institutional environment in the country is important for the management of innovator firms (Porter, 1990). The national IP system is important for promoting national goals, interests and objectives and the management of such an IP system is important for the competitiveness of the country and its innovator firms.. The government therefore needs to evaluate the IP needs of innovators and undertake an in depth review of the current IP laws to ensure they align with new developments and changing IP environments.

There is also need for mentorships to assist the innovators gain IP knowledge and how to develop business processes, develop business partnerships for business success. The local business community

with well established business could provide the mentorship required to assist the innovators develop the appropriate business models for success. IP lawyers have started offering IP clinics during the annual Nairobi innovation week and this needs to be strengthened and scaled up. In addition, the government should set up an innovation revolving fund to provide financial support exclusively to ICT innovators.

There is also need to align competition and IP laws to ensure IP laws do not lead to unfair competition by IP holders especially where government buys and uses such innovations. Government should also offer grants and tax incentives to promote innovations as well as buy services and goods from local innovators for its own use. All government agencies involved in IP development and protection such as KIPI, Universities and colleges, ICT Board of Kenya, Ministry of ICT, Ministry of Trade and Industrialization should align and work harmoniously for a purpose and not at cross-purposes by enhancing and developing regulations for the innovation and IP multi-agency already set up by the government.

Most developed countries have implemented the triple helix of university-industry-government relationships (Etzkowitz, 1993). This ecosystem consists of government support and incentives, educational institutions research and innovators that solve real problems. The US government has supported the growth of the Silicon Valley where educational institutions such as Stanford University exist in an ecosystem that encourages and spurs growth of innovations. The Venture Capital community exists to tap those innovations and develop them into viable business. Global businesses such as Google, Facebook, AirBnB, Paypal, Uber among others have developed from and in this triple helix model.

In Hydrabad, India, the Indian government has supported the development of an ICT city where ICT based business have the environment to grow. Universities, develop the talent required by the industry and the government supports the export of ICT skills to such countries that need them which leads to economic growth. This can be discerned from the success of Indians in the US such as the CEOs of Google – Sundar Pichai and Microsoft - Satya Nadella. Hotmail, which was bought by Microsoft was an innovation by a technology immigrant from Indian called Sabeer Bhatia.

The Israel government has development the Tel Aviv start up city where Tel Aviv University is located as well as a number of technology incubation hubs. This technology ecosystem has led to the developed of many ICT innovations in biomedical, defence systems and systems security.

The Kenyan government has adopted the model of a Technocity with the setting aside of 5,000 acres of land for Konza Technocity. The Kenyan government needs to hasten its steps and actions in setting up the technocity so that the innovation community in Kenya can start to benefit and get the right environment to increase the pace and quality of their innovations. From the examples of different countries above, the

relationship and cooperation between government, academia and business needs to be harnessed for economic growth and job creation. As a starting point, the government should start by having round table discussions on issues pertinent to growth and support of Kenyan innovations. This should lead to a new policy on support of innovations and new IP laws, guidelines and regulations.

5.3.2 Marketing innovations for economic growth

The government has the distinct role of marketing Kenyan innovations globally. At the global level, the fast and explosive growth of the internet has placed innovations at the center of GDP growth for many countries and its increased growth and contribution to GDP has overtaken other traditional sectors such as agriculture, transport and biotechnology among others. The EU, US and parts of Asia have witnessed major waves of wealth creation from ICT innovations. Schumpeter (1934) has argued that governments and entrepreneurs are the prime movers in modern economic development. They foster technological innovations of industries (Tushman and Anderson, 1986) and thereby create new jobs (Birley, 1986). Further, the government's policy on innovation should consider co-creation of innovations between Kenyan innovators and international ICT firms, which will encourage knowledge transfer and sharing and creation of world class innovations. Government should also start marketing Kenyan innovations to global audiences through trade shows and global exhibitions in the same government markets tourism.

Start up innovators and nascent firms face 'a liability of newness' (Stinchcombe, 1965) and it is incumbent upon government to focus on these startups and promote them to create new and business ventures and eventual wealth creation. The entrepreneurial underpinnings and importance of the wealth creation should be of deep interest to government to move to start marketing these firms, which will lead to growth in tax revenues, mainstreaming of the country's ICT potential and GDP growth.

5.3.3 IP strategy

There is a need for Government to put in place a comprehensive intellectual property Policy and strategy that addresses a wide range of issues and assist in the integration of IP into national development strategies and plans. Intellectual property cuts across government ministries, departments and agencies and is therefore cross-sectoral in nature. There is further need for government to ensure policy coherence and coordination.

Government should form a national IP Policy Coordination agency within the Ministry of ICT consisting of representatives of members from Ministry of Finance, ICT, Trade, Interior, private sector, academia, and research think thanks. Such an agency will coordinate policy making, and oversee the implementation of IP Policy. It should further ensure IP integration into the national and sectoral development policies and strategies during policy formulation or revision.

To achieve this, the government would need to undertake a Sector-specific IP audit to have an understanding of what IP exists and in which sectors. To form a baseline of the development of a National IP policy and strategy that may help guide the generation protection and exploitation of IP assets in the country and ensure integration of IP in national development policies, strategies and plans. Such an exercise should consider capacity building and knowledge transfer on IP, setting up an IP Policy coordination agency based on international best practice that takes into account the specific needs and position of the country.

5.3.4 IP legal and institutional framework

Government needs to revise the KIP Act to address and take into account: the requirements of the various international IP treaties to which the government is a party and envisages to be a party to and flexibilities available in international IP conventions and treats including but not limited to the TRIPS agreement by WIPO (specifically ARDI and ASPI initiatives) and relevant WTO conventions for appropriate IP management. The potential for international businesses such as international ICT companies that want to invest in IP, including licensing, international expectations and implications should be adequately considered and covered when carrying out revisions to the existing IP laws and enacting new laws.

5.3.5 IP education and awareness

It is important for Government to design and implement target oriented IP outreach strategy and action program and make IP popularization one of the mandates of KIPI. The organization of regular colloquia for parliamentarians and top officials of the government will appraise them of new changes of IP and their obligations in enacting new IP related laws. The government should also spearhead the review of the IP curriculum and strengthening the effort of primary and secondary schools, tertiary institutions to teach IP and its benefits and for universities to teach IP law students to increase the crop of local IP lawyers

The provision of distance learning opportunities to Kenyan journalists will assist them to understand IP and know how to report and interrogate IP issues as well as inform and educate on the basis of correct information. In conclusion, with the support of WIPO, government should provide IP promotional materials such as the WIPO Academy comic books to teaching, creating awareness about IP and outreach activities to IP holders, researchers, enforcement officers, potential users IP, chamber of commerce and other commerce and industry lobby groups and the general public.

5.3.6 IP enforcement

From the research data analysis, the judiciary was viewed as not being supportive and therefore government through the support of WIPO and other international IP organizations arrange and ensure IP training for judges and facilitating access to IP related judicial decisions made abroad for purposes of establishing local jurisprudence on IP matters. The creation and strengthening IP awareness among

Judges, public prosecutors and police officers through workshops, seminars, colloquium organized on a regular basis will ensure they have regular and up to date relevant information on IP. The provision of in depth and specialized IP training to public investigators and prosecutors under the Director of Public Prosecutions and police officers under the National Police Service will ensure proper investigation and prosecution of IP cases. This will be complemented by the development and delivery of IP curriculum to trainee police officers in the police training college.

5.3.7 IP investment

Based on the need for government to underwrite certain innovation risks, government should provide guidelines for all government agencies to determine when IP on a government project becomes shared IP between the government and innovators, which will ensure the government underwrites further development and any risks associated with such development. There is a need for government to change from the traditional default position of government ownership of IP created under government contracts.

The benefits of these including the innovators, having government as a client and also get funding 'in kind' from government to further improve their innovations. The opportunities for sale of innovations internationally, being underwritten by government, while continuing research and development within Kenya. Increased competition between innovators to commercialize their IP globally and hence quality improvement of their innovations, which will lead to increased ICT career opportunities for Kenyans, especially on government projects and hence provide an attractive industry for skilled ICT graduates which will add to the national stock of skilled ICT graduates for local and international projects.

This will align with whole of government (WoG) approach to local IP support and and improvement, supported by detailed and clear guidance in ministries and departments on how to develop flexible government contract terms for local innovators and co-create new IP with them. This will also ensure that innovators have good government reference sites as they pursue international business opportunities.

6 Implications for further research

This research has focused on ICT innovators and IP, however IP issues affect all innovators and the research could be extended to other innovations in the areas of financial services, agriculture, health, education and trade among other sectors. The research could further be replicated across several countries in Africa such as Anglophone and Francophone Africa. The results of these surveys should be compared with success stories from development nations such as US and UK to ensure Kenyan innovators achieve world-class standards.

The research can be replicated in other parts of the world and the research results so obtained assist in determining whether there are similarities and differences in challenges that innovators face in protecting their innovations. Further research could be undertaken on the substance and form of innovation intermediaries in Kenya and elsewhere in East Africa. There does exist management consultants and knowledge brokers in Kenya and their role and place in the innovation ecosystem is one that needs detailed research. There also exists specific opportunities to undertake further research on the systemic weaknesses of the institutions that have key roles in promoting and protecting IP. The same research could be repeated within the next five or ten years to establish what may have changed or remained the same.

In conclusion, I have discussed the practical areas where knowledge from this research has had an impact. The real value of this research will be determined by future research contexts and such value will be appropriate, accurate and authentic based on the perspective of the readers who will read this research report. Indisputably however, this research has created and contributed immeasurable value to my own growth, learning and scholarly journey. As a leader, scholar practitioner, creative and reflective thinker I know I am better equipped to make a difference to government IP policies and the entrepreneurship journey of many innovators that I will meet in the course of my work and career life.

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Appendix 1 – Research questions

Intellectual property rights and their influence on ICT innovations in Kenya

Quantitative research questionnaire

This questionnaire targets and is focused on entrepreneurs who have developed ICT innovations in Kenya

Please fill in your name and contact details in the relevant boxes at the beginning of the questionnaire. This is for quality control and back check purposes only. If you have any queries regarding the questionnaire or the study, please do not hesitate to contact Joseph Waruingi by email at jkwaruingi@gmail.com or Tel +254-722-706704. Thank you

Introduction

Joseph Waruingi is conducting his doctoral research on Intellectual capital (IC) and property rights (IPRs) as leverage for knowledge and information based organizations. The aim of the research is to explore the challenges faced by ICT innovators in Kenya. Kenya is leading hub of ICT innovations in Sub Saharan Africa and is a suitable country to situate this research.

The aim of this questionnaire is to gather important information for the study, specifically on the following areas:

- government support for innovations
- the capital infrastructure formation
- the innovation ecosystem

Any views obtained from you during the research will not be directly attributed to you by name. All records related to your involvement in this research will be stored in a locked file cabinet. Only the principal investigator will have access to any identifiable information – however, authorized representatives of the University of Liverpool may review your identifiable research information.

Your participation in the research is voluntary. Whether or not you provide your consent for participation will have no effect on your current or future relationship with the University of Liverpool. Furthermore, you may withdraw from the research at any time by providing a written and dated notice

Instructions

I recommend you follow the guidelines detailed below in completing this questionnaire:

- Read each question / statement carefully;
- Read the response instructions carefully to ensure you are recording your views in the required manner;
- Record your first and natural answer;
- If you select an incorrect response from any choices provided by mistake please make a correction by selecting your intended response.
- For narrative responses please provide your best response based on your experience.

Definitions of terms

Please find below definitions of terms used in these questionnaire:

- **Innovation** - The process of translating an idea or invention into a good or service that creates value or for which customers will pay.
- **Innovations eco-system** - the relationships that are formed between actors or entities whose functional goal is to enable technology development and innovation.
- **Innovations footprint** - A measurement of how much individuals or team members are doing to help make an organization more innovative.
- **Intellectual capital** - This is collective knowledge of individuals in an **organization** or society.
- **Intellectual property rights** - A right that is had by a **person or** by a **company** to have exclusive **rights** to use its own **plans**, **ideas**, or other **intangible assets** without the worry of **competition**, at least for a specific **period** of time.

Please copy and use this symbol to select and circle your choice 

Please answer the following questions.

1. Please indicate the highest level of education completed

High school certificate	University degree	Post graduate degree

2. Are you a Kenyan citizen?

Yes	No

3. To what extent do you agree with the following statements relating to ICT innovators in Kenya(use the scale 1= strongly disagree to 5= strongly agree)

CIRCLE ONE NUMBER AGAINST EACH STATEMENT	**strongly disagree**				**strongly agree**
They have an entrepreneurial spirit and desire to innovate	1	2	3	4	5
They understand the concepts of Intellectual capital (IC) and property rights (IPRs)	1	2	3	4	5
They know and understand how to value their innovations	1	2	3	4	5
Over half of ICT innovators that you know have been successful in monetising their innovations and are running profitable businesses	1	2	3	4	5

They understand the existing laws and regulations to protect and nurture their innovations	1	2	3	4	5
Kenyan innovators register and protect their innovations with the relevant government bodies such as the Kenya Industrial Property Institute (KIPI)	1	2	3	4	5

4. To what extent do you agree with the following statements about international ICT companies and their support in terms of IP knowledge to Kenyan ICT innovators and their innovations. (Use the scale 1= strongly disagree to 5= strongly agree).

CIRCLE ONE NUMBER AGAINST EACH STATEMENT	**strongly disagree**				**strongly agree**
They work in partnerships with Kenyan innovators to improved and commercialize their innovations	1	2	3	4	5
They invest in the innovators	1	2	3	4	5
They buy the innovations with no further involvement of the innovators	1	2	3	4	5
The copy the innovators without any compensation	1	2	3	4	5

5. To what extent do you agree with the following statements on the Kenyan government support for ICT innovators(use the scale 1= strongly disagree to 5= strongly agree)

CIRCLE ONE NUMBER AGAINST EACH STATEMENT	**strongly disagree**				**strongly agree**
The Government has developed institutions to support ICT innovators	1	2	3	4	5
The Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations	1	2	3	4	5

You know at least three government agencies that support, nurture and protect ICT innovators	1	2	3	4	5
The Government plays a key role in marketing and promoting Kenya innovators and innovations	1	2	3	4	5
The Government is keen to ensure ICT innovations contribute increasingly to GDP growth	1	2	3	4	5
The judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations	1	2	3	4	5
The government provides avenues for access to grants such as Tandaa grants to provide innovators access to grants to improve their innovations	1	2	3	4	5
The Government provides tax incentives	1	2	3	4	5
The Government provides business opportunities within its ministries and agencies	1	2	3	4	5
The government has set aside 30% of annual government procurement and tenders for youth, women and disabled, which is a great boost for us	1	2	3	4	5

6 Do you consider yourself a young innovator or a business enterprise?

Young innovator	Business enterprise

7 If you are an innovator, have you ever suffered loss of your innovation?

Yes	No

8 If so under what circumstances and to who did you suffer loss of your innovation to?

Please make only one selection - "Yes" or "No" Yes No

During and after pitching to a VCs or PE
To a telecommunications company
To a bank
To a local company
To a foreign company

9 To which of the following age groups do you belong? (please circle one only)

(a) below 24 (b) 25-34 (c) 35-49 (d) 50-64 (e) above 65

10 What is the age of your firm?

(a) below 5 (b) 5-10(c) 11-15 (d) above 15

11 What is the size of your firm in terms of staff?

(a) below 5 (b) 5-10(c) 11-20 (d) above 20

12 What is your job title?

13 How long have you been working in that role?

14 How long have you been involved in ICT innovation?

15 What is your gender?

MaleFemale

Thank you for your invaluable cooperation in completing this questionnaire

If you would like to receive a summary of the research findings, please attach your business card or complete the following details.

Your name: _____

Your organization or innovation hub: _____

Email address: _____

Telephone number: _____

Intellectual property rights and their influence on ICT innovations in Kenya

Qualitative research questionnaire

Please fill in your name and contact details in the relevant boxes at the beginning of the questionnaire. This is for quality control and back check purposes only. If you have any queries regarding the questionnaire or the study, please do not hesitate to contact Joseph Waruingi by email at jkwaruingi@gmail.com or Tel +254-722-706704. Thank you

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The aim of this questionnaire is to gather important information for the study, specifically on the following areas:

- government support for innovations
- the capital infrastructure formation
- the innovation ecosystem

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Your participation in the research is voluntary. Whether or not you provide your consent for participation will have no effect on your current or future relationship with the University of Liverpool. Furthermore, you may withdraw from the research at any time by providing a written and dated notice.

Instructions

I recommend you follow the guidelines detailed below in completing this questionnaire:

- Read each question / statement carefully;

- Read the response instructions carefully to ensure you are recording your views in the required manner;
- Record your first and natural answer;
- If you select an incorrect response from any choices provided by mistake please make a correction by selecting your intended response.
- For narrative responses please provide your best response based on your experience.

This questionnaire is targeted and focused on

- Government officials in agencies such as
    - ICT authority, Kenya National Bureau of Statistics, Kenya Bureau of Standards, Kenya Copyright Board, Vision 2030 delivery secretariat, Kenya Anti-counterfeit Agency and Kenya Industrial Property Institute.
- IP lawyers
- ICT industry practitioners, consultants and investors as well as industry lobby groups

As well as other players and participants in the Kenyan ICT sectors who have interacted with and have a role to play in Kenyan ICT innovations.

- **Innovation -** The process of translating an idea or invention into a good or service that creates value or for which customers will pay.
- **Innovations eco-system -** the relationships that are formed between actors or entities whose functional goal is to enable technology development and innovation.
- **Innovations footprint -** A measurement of how much individuals or team members are doing to help make an organization more innovative.
- **Intellectual capital -** This is collective knowledge of individuals in an **organization** or society.
- **Intellectual property rights -** A right that is had by a **person or** by a **company** to have exclusive **rights** to use its own **plans**, **ideas**, or other **intangible assets** without the worry of **competition**, at least for a specific **period** of time.

Please answer the following themed questions based on your knowledge and role to the best of your ability. Where you do not have an answer or the question does not apply to your current or previous role, please indicate 'Not Applicable'.

Government role (Relevant questions for government officials)

1. Do Kenyan innovators know and apply IP laws to protect their innovations
2. Which Kenyan government institutions, structures and initiatives support, nurture and protect innovations and how supportive to the innovators have they been?
3. Should the Kenyan government continue to support the innovators and if so what more should it do?

IP issues (Relevant questions to IP lawyers and ICT industry practitioners)

1. What IP challenges do Kenyan innovators face?
2. How does Kenya compare with the rest of the world in terms of relevant IP laws and regulations to protect Kenyan ICT innovators?
3. What incentives schemes should the government develop to support the innovators?
4. Are you aware of countries or jurisdictions that have developed supporting and friendly structures and process to innovators? What do those countries do different that you would recommend to the Kenyan government?

Thank you for your invaluable cooperation in completing this questionnaire

If you would like to receive a summary of the research findings, please attach your business card or complete the following details. This is optional.

Your name: _____

Your organization: _____

Email address: _____

Telephone number: _____

Appendix 2 - Tests of relationship and independence

Objective 1 - ICT Innovations and innovators in Kenya

Table 18 – Appendix 2, Objective 1, Test of relationship for ICT innovators on level of education, age, duration and gender

Views on ICT innovators and innovations in Kenya	**Level of Education**			**Age**			**Duration**			**Gender**		
	X	**df**	**p-value**	**X**	**df**	**p-value**	**X**	**df**	**p-value**	**X**	**df**	**p-value**
They have an entrepreneurial spirit and desire to innovate	3.683	4	0.451	5.544	2	0.063	10.453	8	0.235	6.972	2	**0.031***
They know and understand how to value their innovations	0.51	4	0.973	0.84	2	0.657	31.45	8	**0.000****	0.995	2	0.608
Over half of ICT innovators that you know have been successful in monetizing their innovations and are running profitable businesses	4.958	4	0.292	8.751	2	**0.013***	5.308	8	0.724	0.437	2	0.804

They understand the existing laws and regulations to protect and nurture their innovations	18.32	6	**0.005****	3.318	3	0.345	5.242	12	0.949	5.255	3	0.154

Note: p values ***:p≤ 0.05 **: p≤ 0.01**

Table 19 – Appendix 2, Objective 1, Variation in views by level of education

Ranks			
Highest level of education completed		N	Mean Rank
They have an entrepreneurial spirit and desire to innovate	High school certificate	2	19.5
	University degree	34	18.59
	Post graduate degree	1	32
	Total	37	
They know and understand how to value their innovations	High school certificate	2	16.5
	University degree	34	19.22
	Post graduate degree	1	16.5
	Total	37	
Over half of ICT innovators that you know have been successful in monetizing their innovations and are running profitable businesses	High school certificate	2	22.5
	University degree	34	19.07
	Post graduate degree	1	9.5
	Total	37	
They understand the existing laws and regulations to protect and nurture their innovations	High school certificate	2	26.25
	University degree	34	18.68
	Post graduate degree	1	15.5
	Total	37	

Table 20 - Appendix 2, Objective 1, Variation in views by citizenship

Ranks				
Citizenship		N	Mean Rank	**Test statistics**
They have an entrepreneurial spirit and desire to innovate	Yes	33	17.79	chi square = 4.312, df = 1, sig = 0.038
	No	4	29	
	Total	37		
They know and understand how to value their innovations	Yes	33	19.3	chi square = 0.68, df = 1, sig = 0.41
	No	4	16.5	
	Total	37		
Over half of ICT innovators that you know have been successful in monetizing their innovations and are running profitable businesses	Yes	33	20.15	chi square = 4.225, df = 1, sig = 0..04
	No	4	9.5	
	Total	37		
They understand the existing laws and regulations to protect and nurture their innovations	Yes	33	18.77	chi square = 0.29, df = 1, sig = 0.591
	No	4	20.88	
	Total	37		

Table 21 - Appendix 2, Objective 1, Variation in views by age

	Ranks			Test statistics
	Age group	N	Mean Rank	
They have an entrepreneurial spirit and desire to innovate	Below 25	16	19	chi square = 0.000, df = 1, sig =1
	25-34	21	19	
	Total	37		
They know and understand how to value their innovations	Below 25	16	18.75	chi square = 0.043, df = 1, sig = 0.836
	25-34	21	19.19	
	Total	37		
Over half of ICT innovators that you know have been successful in monetising their innovations and are running profitable businesses	Below 25	16	13.63	chi square = 8.502, df = 1, sig = 0.004
	25-34	21	23.1	
	Total	37		
They understand the existing laws and regulations to protect and nurture their innovations	Below 25	16	17.94	chi square = 0.584, df = 1, sig = 0.445
	25-34	21	19.81	
	Total	37		

Table 22 – Appendix 2, Objective 1, Variation in views by work experience

Ranks				Test statistics
How long have you been working in that role?		N	Mean Rank	
They have an entrepreneurial spirit and desire to innovate	1	2	20	chi square = 0.575, df = 4, sig = 0.219
	2	3	19.67	
	3	15	14.67	
	4	16	22	
	5	1	32	
	Total	37		
They know and understand how to value their innovations	1	2	34.5	chi square = 21.225, df = 4, sig = 0.000
	2	3	28.5	
	3	15	17.87	
	4	16	16.5	
	5	1	16.5	
	Total	37		
Over half of ICT innovators that you know have been successful in monetizing their innovations and are running profitable businesses	1	2	9.5	chi square = 3.666, df = 4, sig = 0.453
	2	3	23.67	
	3	15	18.93	
	4	16	19.97	
	5	1	9.5	
	Total	37		
They understand the existing laws and regulations to protect and nurture their innovations	1	2	15.5	chi square =1.604, df = 4, sig = 0.808
	2	3	21.33	
	3	15	18.03	
	4	16	20.13	
	5	1	15.5	
	Total	37		

Table 23 - Appendix 2, Objective 1, Variation in views by gender

Ranks				Test statistics
Gender		N	Mean Rank	
They have an entrepreneurial spirit and desire to innovate	Male	23	20.7	chi square =1.681, df = 1, sig = 0.195
	Female	14	16.21	
	Total	37		
They know and understand how to value their innovations	Male	23	19.74	chi square =0.805, df = 1, sig = 0.37
	Female	14	17.79	
	Total	37		
Over half of ICT innovators that you know have been successful in monetizing their innovations and are running profitable businesses	Male	23	18.22	chi square =0.389, df = 1, sig = 0.533
	Female	14	20.29	
	Total	37		
They understand the existing laws and regulations to protect and nurture their innovations	Male	23	18.09	chi square =0.931, df = 1, sig = 0.335
	Female	14	20.5	
	Total	37		

Objective 2 - International ICT companies and Kenyan ICT innovators

Table 24 - Appendix 2, Objective 2, Variation in views by education

Ranks				
Highest level of education completed		N	Mean Rank	**Test statistics**
They work in partnerships with Kenyan innovators to improved and commercialize their innovations	High school certificate	2	22.25	chi square =5.490, df = 2, sig = 0.064
	University degree	34	18.28	
	Post graduate degree	1	37	
	Total	37		
They invest in the innovators	High school certificate	2	11.5	chi square =4.804, df = 2, sig = 0.091
	University degree	34	18.91	
	Post graduate degree	1	37	
	Total	37		
They buy the innovations with no further involvement of the innovators	High school certificate	2	22.75	chi square =0.815, df = 2, sig = 0.665
	University degree	34	18.96	
	Post graduate degree	1	13	
	Total	37		
The copy the innovators without any compensation	High school certificate	2	6.5	chi square =3.379, df = 2, sig = 0.185
	University degree	34	19.82	
	Post graduate degree	1	16	
	Total	37		

Table 25 - Appendix 2, Objective 2, Variation in views by citizenship

Ranks				
Citizenship		N	Mean Rank	**Test statistics**
They work in partnerships with Kenyan innovators to improved and commercialize their innovations	Yes	33	19.55	chi square =1.374, df = 1, sig = 0.241
	No	4	14.5	
	Total	37		
They invest in the innovators	Yes	33	19.91	chi square =2.775, df = 1, sig = 0.096
	No	4	11.5	
	Total	37		
They buy the innovations with no further involvement of the innovators	Yes	33	17.95	chi square =4.237, df = 1, sig = 0.040
	No	4	27.63	
	Total	37		
The copy the innovators without any compensation	Yes	33	19.58	chi square =0.992, df = 1, sig = 0.319
	No	4	14.25	
	Total	37		

Table 26 - Appendix 2, Objective 2, Variation in views by age

Ranks				
Age group		N	Mean Rank	**Test statistics**
They work in partnerships with Kenyan innovators to improved and commercialize their innovations	Below 25	16	15.72	chi square =4.593, df = 1, sig = 0.032
	25-34	21	21.5	
	Total	37		
They invest in the innovators	Below 25	16	15.44	chi square =3.935, df = 1, sig = 0.040=7
	25-34	21	21.71	
	Total	37		
They buy the innovations with no further involvement of the innovators	Below 25	16	17.88	chi square =0.453, df = 1, sig = 0.501
	25-34	21	19.86	

	Total	37		
The copy the innovators without any compensation	Below 25	16	21.44	chi square =1.643, df = 1, sig = 0.200
	25-34	21	17.14	
	Total	37		

Table 27 - Appendix 2, Objective 2, Variation in views by work experience

Ranks					
How long have you been working in that role?			N	Mean Rank	**Test statistics**
They work in partnerships with Kenyan innovators to improved and commercialize their innovations		1	2	14.5	chi square =8.311, df = 4, sig = 0.081
		2	3	26.17	
		3	15	17.87	
		4	16	18.16	
		5	1	37	
	Total		37		
They invest in the innovators		1	2	18.5	chi square =9.403, df = 4, sig = 0.052
		2	3	25.5	
		3	15	14.3	
		4	16	21.13	
		5	1	37	
	Total		37		
They buy the innovations with no further involvement of the innovators		1	2	13	chi square =4.611, df = 4, sig = 0.330
		2	3	17.5	
		3	15	16.9	
		4	16	22.38	
		5	1	13	
	Total		37		
The copy the innovators without any compensation		1	2	3.5	chi square =10.058, df = 4, sig = 0.039
		2	3	7.67	
		3	15	20.97	
		4	16	21.41	
		5	1	16	
	Total		37		

Table 28 - Appendix 2, Objective 2, Variation in views by gender

Ranks				
Gender		N	Mean Rank	**Test statistics**
They work in partnerships with Kenyan innovators to improved and commercialize their innovations	Male	23	19.2	chi square =0.035, df = 1, sig = 0.851
	Female	14	18.68	
	Total	37		
They invest in the innovators	Male	23	18.7	chi square =0.062, df = 1, sig = 0.803
	Female	14	19.5	
	Total	37		
They buy the innovations with no further involvement of the innovators	Male	23	20.37	chi square =1.448, df = 1, sig = 0.229
	Female	14	16.75	
	Total	37		
The copy the innovators without any compensation	Male	23	17.59	chi square =1.19, df = 1, sig = 0.275
	Female	14	21.32	
	Total	37		

Table 29 – Appendix 2, Objective 2, Test of independence for international ICT companies regarding innovators' level of education, age, duration and gender

International ICT companies with regard to Kenyan ICT innovators and their innovations	**Level of Education**			**Age**			**Duration**			**Gender**		
	X	**df**	**p-value**	**X**	**df**	**p-value**	**X**	**df**	**p-value**	**X**	**df**	**p-value**
They work in partnerships with Kenyan innovators to improved and commercialize their innovations	42.053	6	**0.000****	5.365	3	0.147	44.249	12	**0.000****	3.504	3	0.32
They invest in the innovators	38.385	6	**0.000****	5.099	3	0.165	50.244	12	**0.000****	1.184	3	0.757
They buy the innovations with no further involvement of the innovators	1.088	4	0.896	1.797	2	0.407	10.416	8	0.237	1.882	2	0.39
They copy the innovators without any compensation	8.706	6	0.191	2.206	3	0.531	25.948	12	**0.011****	7.07	3	0.07

Note: p values ***:p≤ 0.05 **: p≤ 0.01**

Objective 3 - Kenyan government support for ICT innovators

Table 30 - Appendix 2, Objective 3, Variation in views by education

Ranks				
Please indicate the highest level of education completed		N	Mean Rank	Test statistics
The Government has developed institutions to support ICT innovators	High school certificate	2	8.5	chi square =4.169, df = 2, sig = 0.124
	University degree	34	19.93	
	Post graduate degree	1	8.5	
	Total	37		
The Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations	High school certificate	2	5.5	chi square =4.076, df = 2, sig = 0.130
	University degree	34	20	
	Post graduate degree	1	12	
	Total	37		
You know at least three government agencies that support, nurture and protect ICT innovators	High school certificate	2	10.25	chi square =2.12, df = 2, sig = 0.346
	University degree	34	19.26	
	Post graduate degree	1	27.5	
	Total	37		
The Government plays a key role in marketing and promoting Kenya innovators and innovations	High school certificate	2	17.25	chi square =3.463, df = 2, sig = 0.177
	University degree	34	18.59	
	Post graduate degree	1	36.5	
	Total	37		
The Government is keen to ensure ICT innovations contribute increasingly to GDP growth	High school certificate	2	8	chi square =2.458, df = 2, sig = 0.293
	University degree	34	19.62	
	Post graduate degree	1	20	
	Total	37		

The judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations	High school certificate	2	24.25	chi square =7.061, df = 2, sig = 0.029
	University degree	34	18.18	
	Post graduate degree	1	36.5	
	Total	37		
The government provides avenues for access to grants such as Tandaa grants to provide innovators access to grants to improve their innovations	High school certificate	2	6.25	chi square =4.609, df = 2, sig = 0.100
	University degree	34	20.04	
	Post graduate degree	1	9	
	Total	37		
The Government provides tax incentives	High school certificate	2	35.5	chi square =17.005, df = 2, sig = 0.0.000
	University degree	34	18.09	
	Post graduate degree	1	17	
	Total	37		
The Government provides business opportunities within its ministries and agencies	High school certificate	2	24	chi square =4.382, df = 2, sig = 0.112
	University degree	34	18.29	
	Post graduate degree	1	33	
	Total	37		
The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for us	High school certificate	2	21.75	chi square =3.988, df = 2, sig = 0.136
	University degree	34	18.35	
	Post graduate degree	1	35.5	
	Total	37		

Table 31 - Appendix 2, Objective 3, Variation in views by citizenship

Ranks				
Are you a Kenyan citizen?		N	Mean Rank	Test statistics
The Government has developed institutions to support ICT innovators	Yes	33	19.71	chi square =1.793, df = 1, sig = 0.181
	No	4	13.13	
	Total	37		
The Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations	Yes	33	20.21	chi square =4.085, df = 1, sig = 0.043
	No	4	9	
	Total	37		
You know at least three government agencies that support, nurture and protect ICT innovators	Yes	33	19.06	chi square =0.01, df = 1, sig = 0.919
	No	4	18.5	
	Total	37		
The Government plays a key role in marketing and promoting Kenya innovators and innovations	Yes	33	18.89	chi square =0.037, df = 1, sig = 0.847
	No	4	19.88	
	Total	37		
The Government is keen to ensure ICT innovations contribute increasingly to GDP growth	Yes	33	19.77	chi square =1.75, df = 1, sig = 0.186
	No	4	12.63	
	Total	37		
The judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations	Yes	33	18.79	chi square =0.252, df = 1, sig = 0.615
	No	4	20.75	
	Total	37		

The government provides avenues for access to grants such as Tandaa grants to provide innovators access to grants to improve their innovations	Yes	33	20.02	chi square =3.137, df = 1, sig = 0.077
	No	4	10.63	
	Total	37		
The Government provides tax incentives	Yes	33	18.68	chi square =0.911, df = 1, sig = 0.34
	No	4	21.63	
	Total	37		
The Government provides business opportunities within its ministries and agencies	Yes	33	19.48	chi square =1.196, df = 1, sig = 0.274
	No	4	15	
	Total	37		
The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for us	Yes	33	19.17	chi square =112, df = 1, sig = 0.738
	No	4	17.63	
	Total	37		

Table 32 - Appendix 2, Objective 3, Variation in views by age

Ranks				
Age group		**N**	**Mean Rank**	**Test statistics**
The Government has developed institutions to support ICT innovators	Below 25	16	22.38	chi square =3.719, df = 1, sig = 0.054
	25-34	21	16.43	
	Total	37		
The Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations	Below 25	16	19.94	chi square =0.226, df = 1, sig = 0.635
	25-34	21	18.29	
	Total	37		
You know at least three government agencies that support, nurture and protect ICT innovators	Below 25	16	21.44	chi square =1.559, df = 1, sig = 0.212
	25-34	21	17.14	
	Total	37		
The Government plays a key role in marketing and promoting Kenya innovators and innovations	Below 25	16	15.06	chi square =4.757, df = 1, sig = 0.029
	25-34	21	22	
	Total	37		
The Government is keen to ensure ICT innovations contribute increasingly to GDP growth	Below 25	16	18.44	chi square =.086, df = 1, sig = 0.0770
	25-34	21	19.43	
	Total	37		
The judiciary understands and supports Kenyan	Below 25	1	15.5	chi square

innovators from losing their innovations to unscrupulous individuals or organizations		6		=6.343, df = 1, sig = 0.012
	25-34	21	21.67	
	Total	37		
The government provides avenues for access to grants such as Tandaa grants to provide innovators access to grants to improve their innovations	Below 25	16	20.19	chi square =0.396, df = 1, sig = 0.529
	25-34	21	18.1	
	Total	37		
The Government provides tax incentives	Below 25	16	18.16	chi square =592, df = 1, sig = 0.442
	25-34	21	19.64	
	Total	37		
The Government provides business opportunities within its ministries and agencies	Below 25	16	16.13	chi square =3.884, df = 1, sig = 0.049
	25-34	21	21.19	
	Total	37		
The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for us	Below 25	16	15.56	chi square =4.405, df = 1, sig = 0.036
	25-34	21	21.62	
	Total	37		

Table 33 - Appendix 2, Objective 3, Variation in views by working experience

Ranks				
How long have you been working in that role?		N	Mean Rank	Test statistics
The Government has developed institutions to support ICT innovators	1	2	27	chi square =6.119, df = 4, sig = 0.190
	2	3	14.67	
	3	15	22.07	
	4	16	16.59	
	5	1	8.5	
	Total	37		
The Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations	1	2	5.5	chi square =9.652, df = 4, sig = 0.047
	2	3	7.67	
	3	15	19.23	
	4	16	23.03	
	5	1	12	
	Total	37		
You know at least three government agencies that support, nurture and protect ICT innovators	1	2	5	chi square =12.302, df = 4, sig = 0.015
	2	3	5	
	3	15	18.73	
	4	16	23.09	
	5	1	27.5	
	Total	37		
The Government plays a key role in marketing and promoting Kenya innovators and innovations	1	2	17.25	chi square =4.542, df = 4, sig = 0.338
	2	3	14.33	
	3	15	17.83	
	4	16	20.09	
	5	1	36.5	
	Total	37		
The Government is keen to ensure ICT innovations contribute increasingly to GDP growth	1	2	5.25	chi square =7.495, df = 4, sig = 0.112
	2	3	10.17	
	3	15	22.33	
	4	16	19.19	
	5	1	20	
	Total	37		
The judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations	1	2	15.5	chi square =10.477, df = 4, sig = 0.033
	2	3	27.17	
	3	15	17.83	
	4	16	17.91	
	5	1	36.5	
	Total	37		
The government provides avenues	1	2	3.5	chi square

for access to grants such as Tandaa grants to provide innovators access to grants to improve their innovations	2	3	7.17	=11.989, df = 4, sig = 0.017
	3	15	22.13	
	4	16	20.84	
	5	1	9	
	Total	37		
The Government provides tax incentives	1	2	17	chi square =2.322, df = 4, sig = 0.677
	2	3	23.17	
	3	15	19.47	
	4	16	18.16	
	5	1	17	
	Total	37		
The Government provides business opportunities within its ministries and agencies	1	2	15	chi square =4.109, df = 4, sig = 0.392
	2	3	21	
	3	15	18.87	
	4	16	18.38	
	5	1	33	
	Total	37		
The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for us	1	2	30	chi square =16.025, df = 4, sig = 0.003
	2	3	31.83	
	3	15	17.17	
	4	16	15.91	
	5	1	35.5	
	Total	37		

Table 34 - Appendix 2, Objective 3, Variation in views by gender

Ranks				
Gender		N	Mean Rank	**Test statistics**
The Government has developed institutions to support ICT innovators	Male	23	17.35	chi square =1.922, df = 1, sig = 0.166
	Female	14	21.71	
	Total	37		
The Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations	Male	23	14.76	chi square =9.945, df = 1, sig = 0.002
	Female	14	25.96	
	Total	37		
You know at least three government agencies that support, nurture and protect ICT innovators	Male	23	14.8	chi square =9.962, df = 1, sig = 0.002
	Female	14	25.89	
	Total	37		
The Government plays a key role in marketing and promoting Kenya innovators and innovations	Male	23	21.59	chi square =4.428, df = 1, sig = 0.035
	Female	14	14.75	
	Total	37		
The Government is keen to ensure ICT innovations contribute increasingly to GDP growth	Male	23	15.07	chi square =9.038, df = 1, sig = 0.003
	Female	14	25.46	
	Total	37		
The judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations	Male	23	20.37	chi square =2.094, df = 1, sig = 0.148
	Female	14	16.75	
	Total	37		
The government provides avenues for access to grants such as Tandaa grants to provide innovators access to grants to improve their innovations	Male	23	15.09	chi square =9.282, df = 1, sig = 0.002
	Female	14	25.43	
	Total	37		
The Government provides tax incentives	Male	23	20.22	chi square =2.656, df = 1, sig = 0.103
	Female	14	17	
	Total	37		
The Government provides business opportunities within its ministries and agencies	Male	23	21.43	chi square =6.006, df = 1, sig = 0.014
	Female	14	15	
	Total	37		
The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for us	Male	23	21.39	chi square =4.596, df = 1, sig = 0.032
	Female	14	15.07	
	Total	37		

Table 35 – Appendix 2, Objective 3, Test of independence for Kenya government support on level of education, age, duration and gender

	Level of Education			Age			Duration			Gender		
Kenyan government support for ICT	**X**	**df**	**p-value**	**X**	**df**	**p-value**	**X**	**df**	**p-value**	**X**	**df**	**p-value**
The Government has developed institutions to support ICT innovators	4.285	2	0.117	3.823	1	0.051	6.289	4	0.179	1.975	1	0.16
The Government learns from the best in the world about how to nurture and protect Kenyan innovators and their innovations	17.267	8	**0.027***	5.918	4	0.205	28.661	16	**0.026***	10.59	4	**0.032***
You know at least three government agencies that support, nurture and protect ICT innovators	3.718	6	0.715	4.857	3	0.183	21.596	12	**0.042***	11.609	3	**0.009****
The Government plays a key role in marketing and promoting Kenya innovators and innovations	18.035	4	**0.001****	4.994	2	0.082	19.443	8	**0.013***	4.596	2	0.1

The Government is keen to ensure ICT innovations contribute increasingly to GDP growth	10.169	8	0.253	4.653	4	0.325	16.226	16	0.437	10.794	4	**0.029***
The judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations	20.35	4	**0.000****	6.578	2	**0.037***	26.84	8	**0.001****	2.279	2	0.32
The government provides avenues for access to grants such as Tandaa grants to provide innovators access to grants to improve their innovations	11.971	8	0.153	4.662	4	0.324	34.357	16	**0.005****	10.059	4	**0.039***
The Government provides tax incentives	17.478	2	**0.000****	0.608	1	0.435	2.386	4	0.665	2.73	1	0.098
The Government provides business opportunities within its ministries and agencies	5.961	4	0.202	4.003	2	0.135	6.874	8	0.55	6.213	2	**0.045***
The government has set aside 30% of annual government procurement and	9.809	4	**0.044***	4.852	2	0.088	26.981	8	**0.001****	6.176	2	**0.046***

tenders for youth, women and disabled which is a great boost for us	

Note: p values ***:p≤ 0.05 **: p≤ 0.01**

Appendix 3 – Descriptive statistics frequency tables

Table 36 - Appendix 3, Education frequency table

Please indicate the highest level of education completed				
	Frequency	Percent	Valid Percent	Cumulative Percent
High school certificate	2	5.4	5.4	5.4
University degree	34	91.9	91.9	97.3
Post graduate degree	1	2.7	2.7	100.0
Total	37	100.0	100.0	

Table 37 - Appendix 3, Citizenship frequency table

Are you a Kenyan citizen?				
	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	33	89.2	89.2	89.2
No	4	10.8	10.8	100.0
Total	37	100.0	100.0	

Table 38 - Appendix 3, Frequency on circumstances of innovation loss

Under what circumstances and to who did you suffer loss of your innovation to?	Yes	No	Total
During and after pitching to a VCs or PE	100.0%	0.0%	100.0%
To a telecommunications company	0.0%	100.0%	100.0%
To a bank	0.0%	100.0%	100.0%
To a local company	100.0%	0.0%	100.0%
To a foreign company	0.0%	100.0%	100.0%

Table 39 - Appendix 3, Frequency on duration in ICT innovation

	Frequency	Percent	Valid Percent	Cumulative Percent
3	5	13.5	13.5	13.5
4	7	18.9	18.9	32.4
5	10	27.0	27.0	59.5
6	7	18.9	18.9	78.4
7	4	10.8	10.8	89.2
8	1	2.7	2.7	91.9
10	3	8.1	8.1	100.0
Total	37	100.0	100.0	

Appendix 4 – Skewness and kurtosis

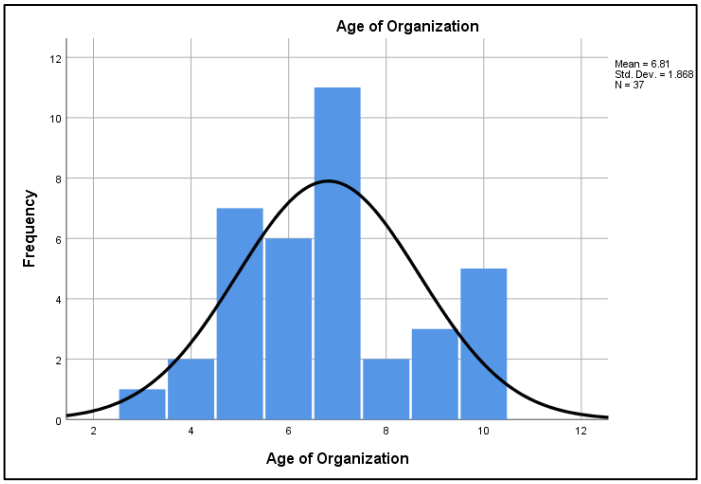
Table 40 - Appendix 5, Hypothesis summary for skewness and kurtosis

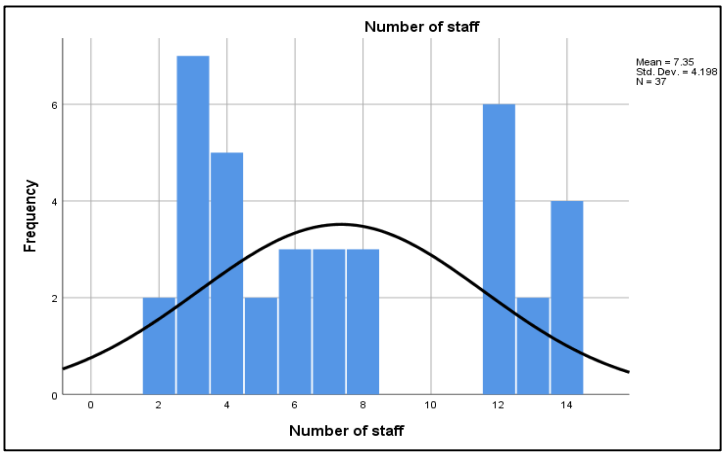
	Null Hypothesis	Test	Sig.	Decision
1	The Distribution of Age of Organization is Normal with mean 7 and standard deviation 1.868	One-Sample Kolmogorov-Smirnov Test	0.002[1]	Reject the null hypothesis
2	The Distribution of Number of staff Normal with mean 7 and standard deviation 4.198	One-Sample Kolmogorov-Smirnov Test	0.002[1]	Reject the null hypothesis

Asymptotic significances are displayed. The significance level is 0.05

[1] Lilliefors corrected

Figure 7 - Appendix 5, Normal curve test for data




Number of staff
Mean = 7.35
Std. Dev. = 4.198
N = 37
Frequency
0
2
4
6
0
2
4
6
8
10
12
14
Number of staff

Appendix 5 – Data reliability statistics

Table 41 - Appendix 4, Cronbach's Alpha

Cronbach's Alpha	N. of variables
0.734	35

Variable-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
ICT innovators and innovations in Kenya - They have an entrepreneurial spirit and desire to innovate	66.97	72.471	0.204	0.730
ICT innovators and innovations in Kenya - They understand the concepts of Intellectual capital (IC) and property rights (IPRs)	69.68	73.059	0.228	0.728
ICT innovators and innovations in Kenya - They know and understand how to value their innovations	69.76	72.856	0.386	0.725
ICT innovators and innovations in Kenya - Over half of ICT innovators that you know have been successful in monetising their innovations and are running profitable businesses	69.30	74.326	0.100	0.734
ICT innovators and innovations in Kenya - They understand the existing laws and regulations to protect and nurture their innovations	69.62	75.131	0.017	0.739

ICT innovators and their businesses - They have registered business and comply with all law	69.24	73.134	0.145	0.733
ICT innovators and their businesses - They have developed business plans and guide their business growth plans	69.86	73.731	0.554	0.726
ICT innovators and their businesses - They run profitable businesses	69.43	70.363	0.349	0.721
ICT innovators and their businesses - They relentlessly pursue grants opportunities with government and other international agencies to improve their innovations	69.35	70.679	0.311	0.723
ICT innovators and their businesses - They have developed Standards Operating Procedures (SOPs) for their businesses	69.78	73.285	0.297	0.727
ICT innovators and their businesses - They have well developed hiring procedures and incentives to motivate and retain their staff talent	69.92	75.965	0.000	0.734
ICT innovators and their businesses - They have Research and Development sections/divisions/department to manage innovations growth	69.78	72.174	0.623	0.721
ICT innovators and their businesses - Kenyan innovators register and protect their innovations with the relevant government bodies such as the Kenya Industrial Property Institute (KIPI)	69.78	74.341	0.168	0.731
Kenyan government support for ICT - The Government has developed institutions to support ICT innovators	68.35	79.123	-0.382	0.750

Kenyan government support for ICT - You know at least three government agencies that support, nurture and protect ICT innovators	68.62	83.742	-0.492	0.773
Kenyan government support for ICT - The Government plays a key role in marketing and promoting Kenya innovators and innovations	69.30	73.881	0.170	0.731
Kenyan government support for ICT - The Government is keen to ensure ICT innovations contribute increasingly to GDP growth	68.03	78.527	-0.199	0.758
Kenyan government support for ICT - The judiciary understands and supports Kenyan innovators from losing their innovations to unscrupulous individuals or organizations	69.68	70.670	0.542	0.717
Kenyan government support for ICT - The Government provides tax incentives	69.81	74.658	0.222	0.731
Kenyan government support for ICT - The Government provides business opportunities within its ministries and agencies	69.65	70.623	0.487	0.717
Kenyan government support for ICT - The government has set aside 30% of annual government procurement and tenders for youth, women and disabled which is a great boost for us	69.30	59.159	0.789	0.678
Venture Capitalists (VCs) and Private Equities (PEs) investing or seeking to invest in ICT innovators in Kenya - The VCs and PEs are good partners in the innovations' ecosystem	67.97	72.694	0.109	0.738

Venture Capitalists (VCs) and Private Equities (PEs) investing or seeking to invest in ICT innovators in Kenya - The process of engaging and receiving funding from VCs or PEs is clear and straig	69.70	71.548	0.457	0.720
How and where you have promoted your innovations - We have promoted them in the mainstream (TV, newspapers, magazines) and/or social media	69.49	65.535	0.537	0.705
How and where you have promoted your innovations - We have approached government for business	69.41	68.248	0.412	0.716
How and where you have promoted your innovations - We have sought to partner with bigger firms for knowledge and skills transfer	68.46	64.477	0.421	0.713
How and where you have promoted your innovations - We have show-cased our innovations in government forums, shows, trade fairs such as Demo Africa	67.11	75.099	-0.013	0.746
How and where you have promoted your innovations - We have participated in government tender opportunities	69.43	70.641	0.367	0.721
International ICT companies with regard to Kenyan ICT innovators and their innovations - They work in partnerships with Kenyan innovators to improved and commercialise their innovations	69.49	65.368	0.734	0.697
International ICT companies with	69.24	68.578	0.433	0.715

regard to Kenyan ICT innovators and their innovations - They invest in the innovators				
International ICT companies with regard to Kenyan ICT innovators and their innovations - They buy the innovations with no further involvement of the innovators	69.32	73.336	0.119	0.735
Future of Kenyan ICT innovators and innovations - It is bright and promising despite previous and current challenges	66.95	69.608	0.371	0.719
Future of Kenyan ICT innovators and innovations - Young and growing fast in the Sub Saharan region	66.76	73.745	0.148	0.732
Future of Kenyan ICT innovators and innovations - Kenya is a leading innovation hub and this will continue to grow	66.43	70.030	0.670	0.713
Future of Kenyan ICT innovators and innovations - Innovators will continue to attract increasing global attention and investments	66.27	77.869	-0.186	0.749